RUBBER WORLD

OUR 66th YEAR

A BILL BROTHERS PUBLICATION

NOVEMBER, 1954

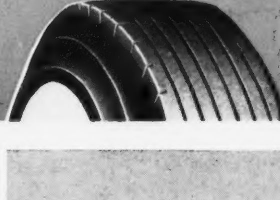
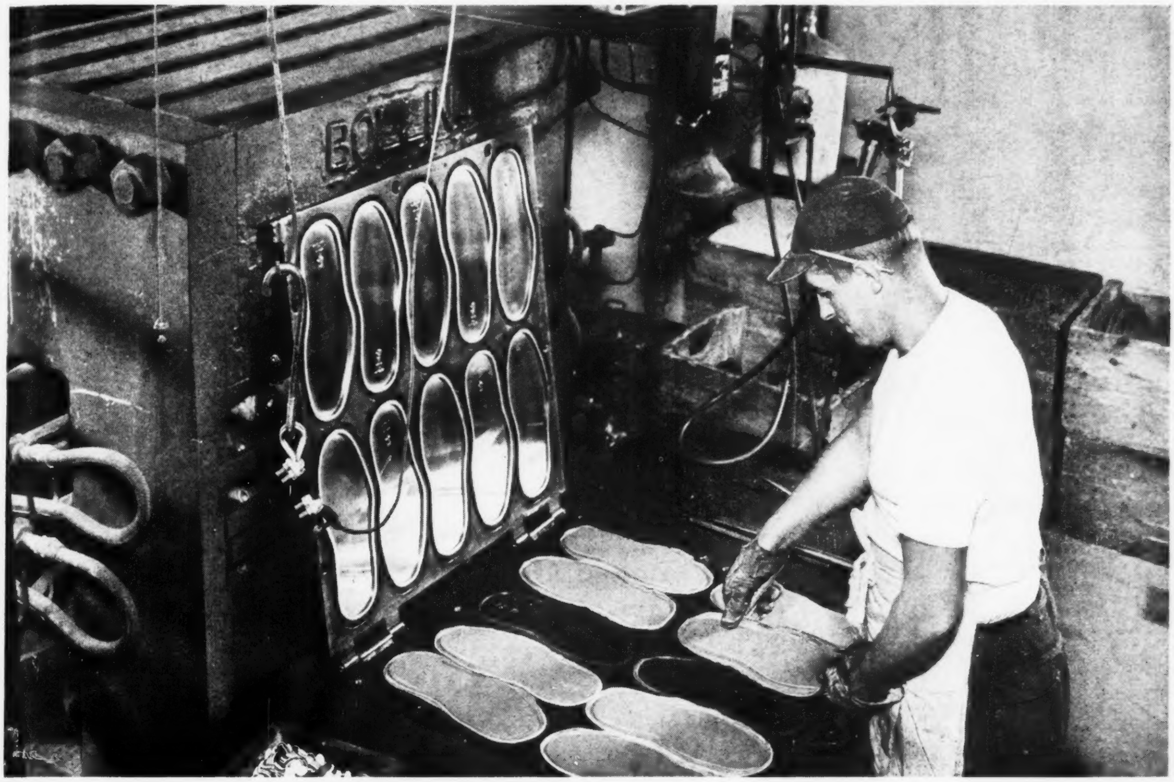


TABLE OF CONTENTS ON PAGE 215

RUBBER WORLD, November, 1954, Vol. 131, No. 2. Published monthly by BILL BROTHERS PUBLISHING CORP. Office of Publication, 1309 Noble Street, Philadelphia, Pa., with Editorial and Executive Offices at 386 Fourth Avenue, New York 16, N. Y., U.S.A. Entered as Second Class Matter at the Post Office at Philadelphia, Pa., under the act of March 3, 1879. Subscription United States, $5.00 per year; Canada, $6.00; All other countries $7.00; Single Copies 50 cents. Address Mail to N. Y. Office.

HELPING HANDS for chemical workers that stay on the job longer are these heavy-duty gloves of CHEMIGUM — the easy-processing nitrile rubber. They are made by multiple dipping solution of rubber cement onto the porcelain forms. Photo courtesy Charleston Rubber Company, Charleston, S. C.

FINER SOLES FASTER and at lower cost come from using PLIOLITE S-6B—the easier-handling, easier-processing rubber reinforcing resin. Photo courtesy New Jersey Rubber Company, Taunton, Mass.



BIGGER PROFITS IN THE MAKING

with easier-processing PLIOLITE S-6B

A CONSTANT high bulk density that means easier handling, more pounds per batch and more batches per day. A non-dusting, easily friable granule that means less resin loss, more reinforcement per pound. A faster, more thorough dispersion that means greater reinforcement from less resin. These are the properties of PLIOLITE S-6B that make for bigger profits in nuclear-type shoe soles.

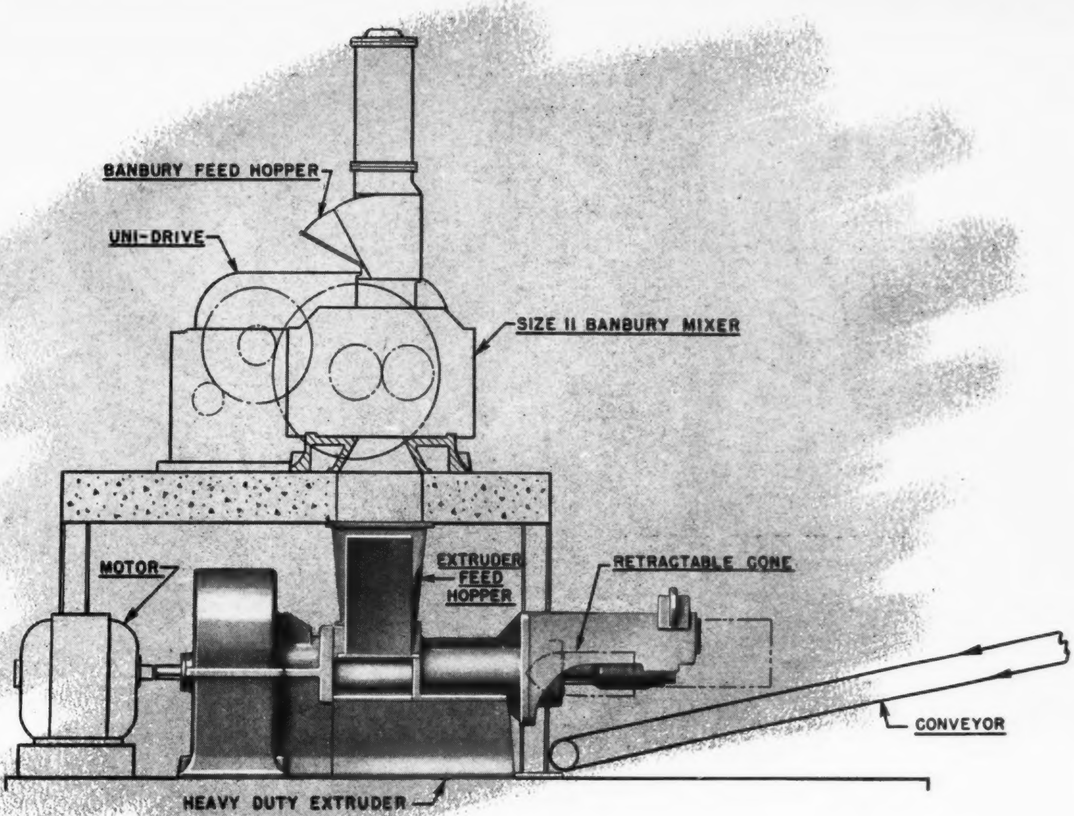
PLIOLITE S-6B is a high styrene copolymer specifically designed and made to give easier processing without sacrifice of the physical properties essential to a good shoe sole. High hardness, low gravity, excellent flex- and abrasion-resistance, uniformity and excellent hot tear strength are the characteristics of rubber reinforced with PLIOLITE S-6B that add up to better production and performance of the sole.

Samples and full technical help on PLIOLITE S-6B from the foremost supplier of synthetic rubbers and related resins are yours by writing to:

Goodyear, Chemical Division, Akron 16, Ohio

CHEMICAL GOODYEAR DIVISION

Use-Proved Products—CHEMIGUM • PLIOBOND • PLIOLITE • PLIO-TUF • PLIOVIC • WING-CHEMICALS—The Finest Chemicals for Industry



HOW TO CASH IN ON THE FULL POTENTIAL OF YOUR BANBURY* MIXER

In the setup diagrammed, a Farrel-Birmingham 15″ extruder handles the full output of a size 11 Banbury mixer on short-cycle operation of 1½ to 2½ minutes.

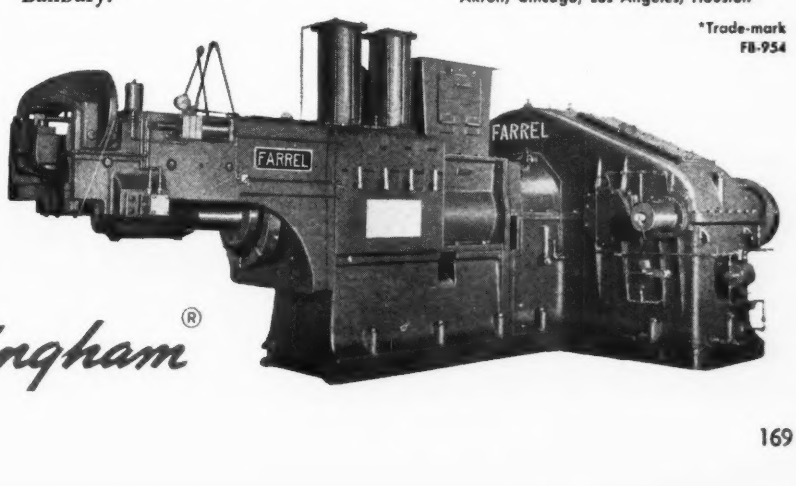
On longer-cycle operation, it can be used with two size 11 Banbury mixers. A belt conveyor carries the discharge from one mixer to the extruder hopper, alternating with the gravity feed from the other Banbury. With this arrangement, production can be maintained at 10,000 to 18,000 pounds per hour.

Using extruders to handle Banbury output, you cut out the bottleneck of milling operations following Banbury processing, at the same time eliminating all manual handling connected with milling. Operation is automatic; flow of material is accelerated and simplified; the plasticity of stock worked by the extruder screw is more uniform than that of milled stock; and stocks are generally at no higher temperature leaving the extruder than they are when discharged from the Banbury.

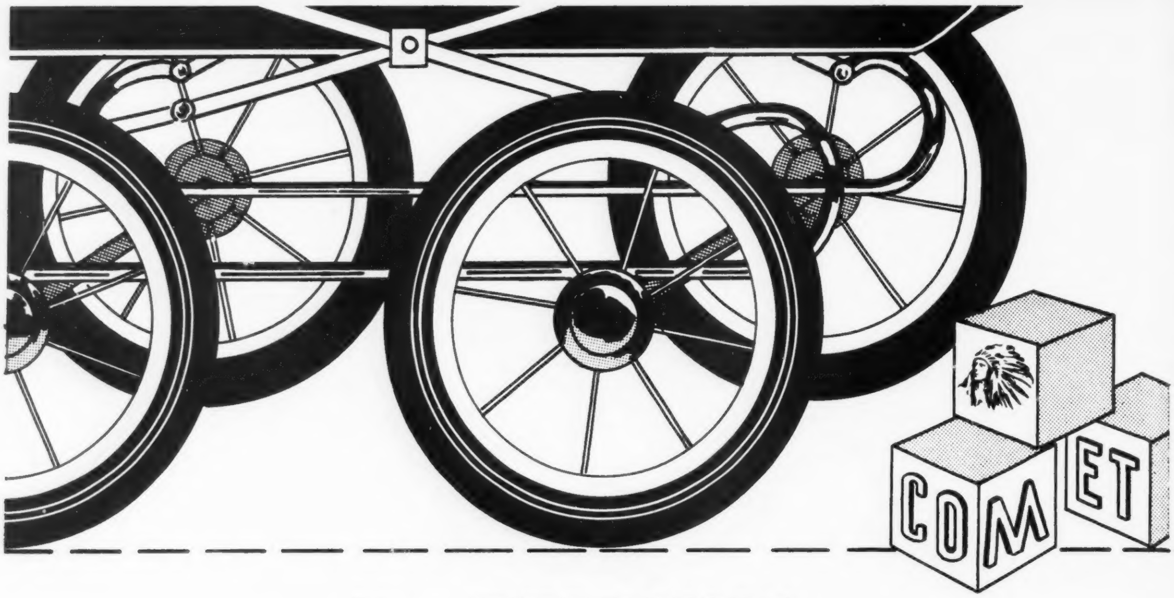
Further information will be sent on request, or we shall be glad to have our engineers recommend an installation suited to your production requirements.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT
Plants: Ansonia and Derby, Conn., Buffalo, N.Y.
Sales Offices: Ansonia, Buffalo, New York, Akron, Chicago, Los Angeles, Houston

*Trade-mark
FB-954



Farrel-Birmingham®


COMET


This is your dish!
SUPERIOR PROCESSING
Marbon "8000-A"
Reinforcing High Styrene Resin
Whether You're Making Molded Rubber Sink Mats or Soap Dishes - This is your Dish for Economy!
Marbon "8000-A" fluxes rapidly at lower temperatures (165-175 degrees F.) for improved dispersion, shorter mixing cycles, faster heat-plasticizing action with lowered power demand. A superior-processing resin with all the reinforcing properties of Marbon 8000. Especially suitable for open-mill mixing under marginal heat conditions.
WRITE Today FOR COMPLETE TECHNICAL LITERATURE
Marbon
MARBON CORP.
GARY, INDIANA
SUBSIDIARY OF BORG-WARNER
It BLENDS as it STRENGTHENS as it IMPROVES

Increased operating efficiency; lower operating costs with mixer on TIMKEN® bearings

HERE are the reasons Stewart Bolling & Company, Inc., Cleveland, uses Timken® tapered roller bearings in the split end frame housings of its intensive plastic and rubber mixers:

Timken bearings do away with extra thrust devices that cause power loss through friction. Because of their tapered design, the Timken bearings can withstand the continually changing rotor end thrust as well as the radial loads. Rotor end-play is eliminated.

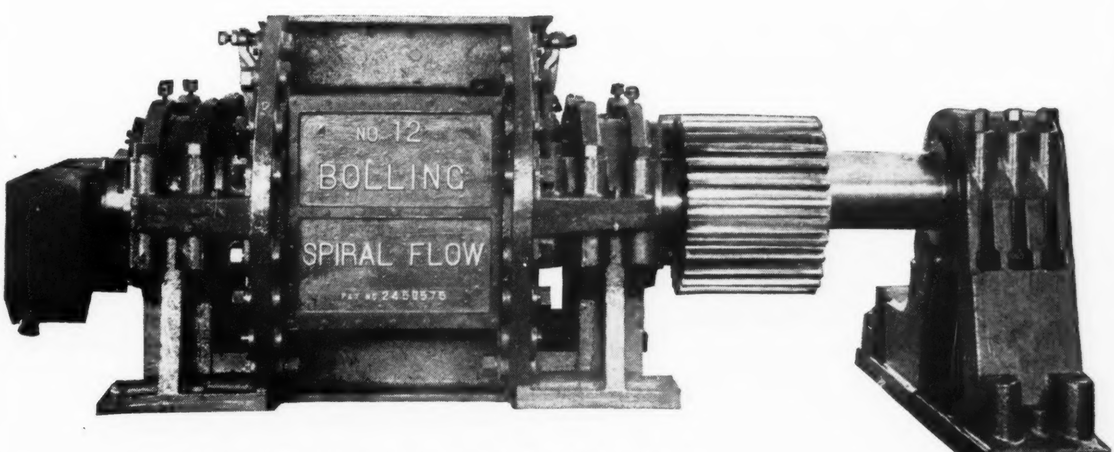
Timken bearings also maintain true centers within very minute limits, maintaining established clearances between rotors. Gears operate indefinitely on their original pitch lines, greatly reducing gear wear and replacement.

And Timken bearings, themselves, last and last because rollers and races are case-hardened to give them hard, wear-resistant surfaces over tough, shock-resistant cores.

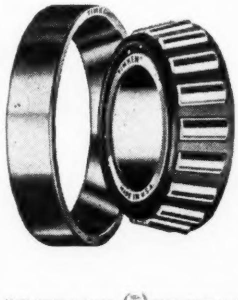
Overall result: Higher mixing speeds, improved performance, lower maintenance cost, less downtime and lower operating cost per pound.

Look for the trade-mark "Timken" stamped on every bearing to get these same advantages on your machinery. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



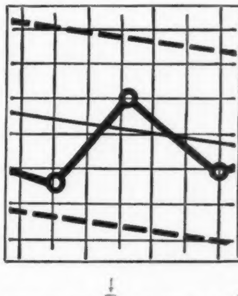
STEWART BOLLING & COMPANY, INC. uses Timken bearings in the split-end frames on the #12 intensive mixer rotor journal to cut operating costs, assure long, trouble-free service.



TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



STATISTICAL QUALITY CONTROL

To insure uniform high quality and closer tolerances, the Timken Company uses statistical quality control. With it, tolerance deviations are plotted graphically. It's one of industry's newest, most scientific methods of improving product uniformity.

NOT JUST A BALL NOT JUST A ROLLER THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION


Geared

"No experience necessary"?

Skellysolve for Rubber and Related Industries

SKELLYSOLVE-B. For making quick-setting cements for the shoe, tape, container, tire and other industries. Quick-drying, with no foreign taste or odor in dried compound.

SKELLYSOLVE-C. For making quick-setting cements with a somewhat slower drying rate than those compounded with Skellysolve-B.

SKELLYSOLVE-D. For cements and variety of manufacturing operations. Good odor. Quick drying. Minimum of heavy, greasy compounds.

SKELLYSOLVE-H. For general use in manufacturing operations and cements, where faster evaporation rate than that of Skellysolve-D is desired.

SKELLYSOLVE-E. For use wherever a relatively slow drying solvent is desired.

SKELLYSOLVE-R. For general use in tire building and a variety of other manufacturing operations and cements. Reduces evaporation losses. Medium quick final dry. Lessens bloating and skinning tendency.

"Doc" MacGEE says: Experience is *more* than necessary in some fields . . . it is *vital*. In solvents, you can rely unreservedly on Skellysolve . . . for every shipment is backed by more than 20 progressive years of concentrated solvent experience.

You benefit from that experience in uniformity of solvent characteristics. One batch of Skellysolve is the same as the next because of the strict quality controls that check every step in the manufacturing process. Shipment after shipment gives you the same over-all solvent properties that safeguard your product's uniformly high quality—the best "advertising" any product can possess!

What solvent property is most important in your plant operations? Whether it's low end points, quick evaporation, reduced blushing tendency, low vapor pressure, minimum of unsaturates and pyrogenic decomposition products or a minimum of low and high boiling compounds—Skellysolve checks!

Compare Skellysolve, too, for controlled vapor pressure—assurance against bloated containers. And if rubber cements are your business, Skellysolve's minimum of low boiling compounds banishes worry about "seeds" in your products. High bonding strength is certain with Skellysolve's freedom from greasy residues.

You're invited to write for more complete technical facts. And if you have a special solvent application problem, see if the Skellysolve Technical Fieldman can help you. No obligation.

SKELLY

Skellysolve

SOLVENTS DIVISION, SKELLY OIL COMPANY
KANSAS CITY, MISSOURI


QUICK TRIM FLASHING
for as little as
1/4 your present cost!
with Western's
RMH Machine
The machine of 1000 Uses
WESTERN
Dies cut on a replaceable hardened steel plate. Foot control speeds operation. Simple, positive pressure adjustment. Positive safety devices on machine. 1/2 H.P. motor.
Cuts, punches and trims flashing
in one swift operation!
CUTS PARTS FROM SHEET STOCK SEND US A SAMPLE of parts to be cut or flash trimmed for our recommendations.
Send for our illustrated catalog
WE SPECIALIZE IN
DIES
WESTERN SUPPLIES CO., 2920 CASS AVE., SAINT LOUIS 6, MO.

A guide for selecting

SHELL DUTREX®

PLASTICIZERS and EXTENDERS

For GR-S and Natural Rubber

For highly loaded stocks use

DUTREX 6
DUTREX 6 H (SPX-97)
DUTREX 20

For general purpose applications use

DUTREX 6
DUTREX 7
DUTREX 15E
DUTREX 15W
DUTREX 6 H (SPX-97)
DUTREX 20

For Buna N synthetic rubber

DUTREX 21
DUTREX 25

For Neoprene WHV

DUTREX 6
DUTREX 20

SHELL OIL COMPANY

50 WEST 50th STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

look and see

If you look at the facts, you will see the advantages of specifying A. Gross & Company as your STEARIC ACID supplier.

Over the years, prior to the manufacture of hydrogenated Stearic Acids, A. Gross & Company supplied the rubber industry with Stearic Acids made by the "pressing" method.

Currently, A. Gross & Company offers a complete line of hydrogenated fatty acids of high quality and low prices, produced by A. Gross' "know how". For the rubber industry, we offer a Hydrogenated Rubber Grade Stearic Acid carrying the A. Gross guarantee of uniformity.

Our location in Newark, New Jersey, makes available to eastern consumers a ready source of supply for Hydrogenated Rubber Grade Stearic Acid. Nation-wide distribution points service others promptly.

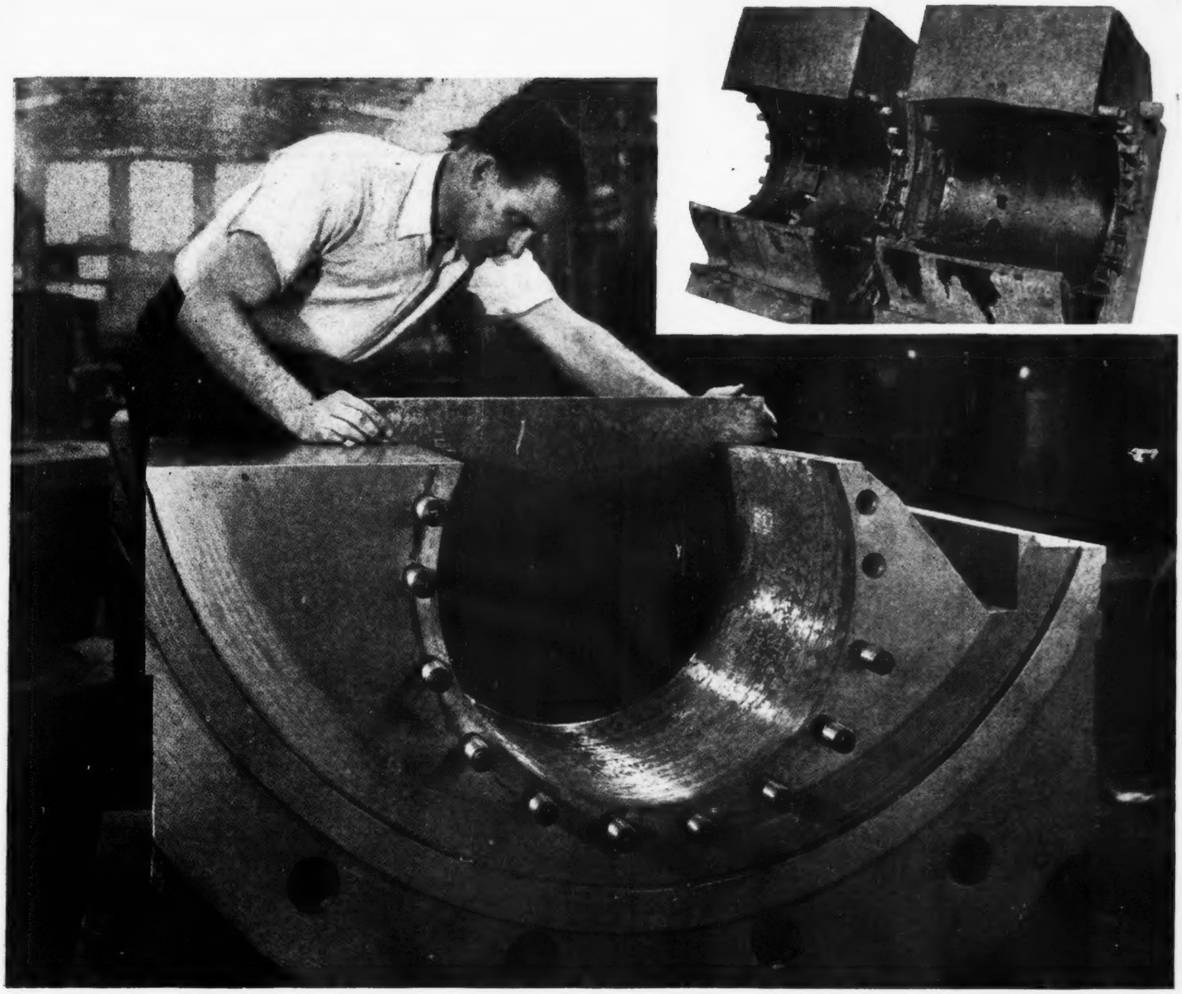
HYDROGENATED RUBBER GRADE STEARIC ACID

Titre	54° C min.
Color	9 FAC min.
Saponification Value	200 - 204
Acid Value	195 - 200
Iodine Value	7 min.

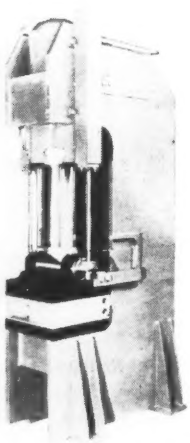
A. GROSS & Company

Manufacturers Since 1837

295 Madison Ave., New York 17, N. Y.
Factory, Newark, N. J. Distributors in Principal Cities



Battery of specially designed presses for mass production.



Tilting-head hydraulic press offers operator easy access and quicker operation.

Siempelkamp

HYDRAULIC PRESSES

Some 36,000 square yards of factory space within a total area of 240,000 square yards is available for production work on the most modern hydraulic vulcanizing presses.

Write for quotations on your next job.

All points outside U.S.A. send inquiries direct to:

G. SIEMPELKAMP & CO., KREFELD, WEST GERMANY
(Established 1883)

Telex 0853 811 Cable: Siempelkampco

EXCLUSIVE REPRESENTATIVE IN U.S.A. TO RUBBER AND PLASTICS INDUSTRIES

William Tapper

W T

30 South Broadway,
Yonkers, New York

Phone: Yonkers 3-7455 Cable: Wiltapper


A GOOD FAMILY TO KNOW BETTER for Economy Reasons
PICCO
RESINS
FOR EVERY PURPOSE in Various Melting Points

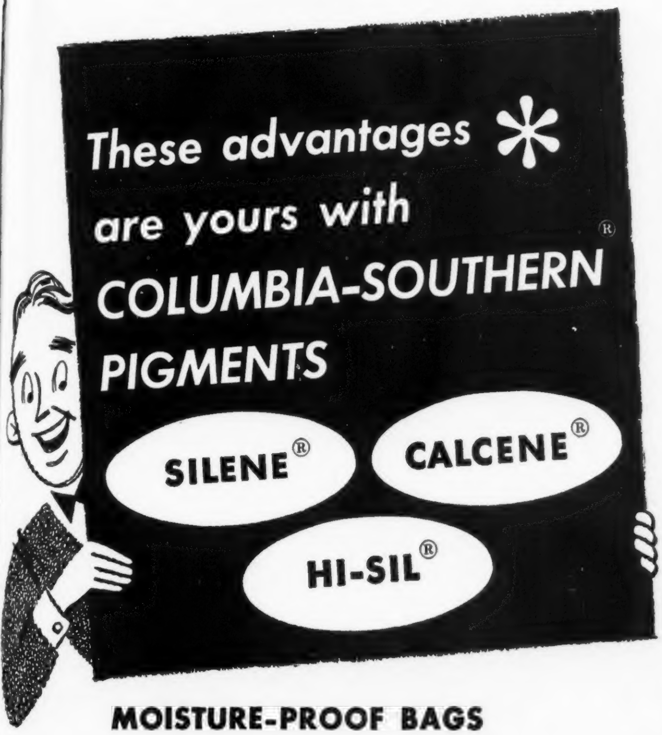
UNITIZED SHIPMENTS

Silene's 50 lb. bags are ideally suited to unitized loadings of up to 48 bags at one time on the new Uni-board.

Saves you time and money, reduces package breakage, assures you minimum carload weight.

COMPLETE RANGE OF MATERIALS

Silene, Calcene and Hi-Sil not only have their individual average particle sizes, but each pigment also has its own other unique physical properties. This variety enables you to get the results you desire.



DENSIFIED PACKAGING

Silene and Hi-Sil are now packaged in a new densified form. The compact paper bags make for greater convenience, easier handling and storage.

TECHNICAL SERVICE

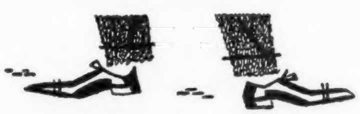
Columbia-Southern's technical staff is always glad to give you assistance with your problems involving pigments. They will cooperate with you and exchange information. They will provide experimental working samples.

MOISTURE-PROOF BAGS

Upon request, Silene is furnished in sturdy, moisture-proof bags that keep the contents dry and in excellent condition. Moisture-proof bags are easy to handle but they cannot be unitized.

STEADY SUPPLY—PROMPT SHIPMENTS

Columbia-Southern is a large scale producer of pigments; inventories are not allowed to run out. Shipments are prompt and are given careful attention.



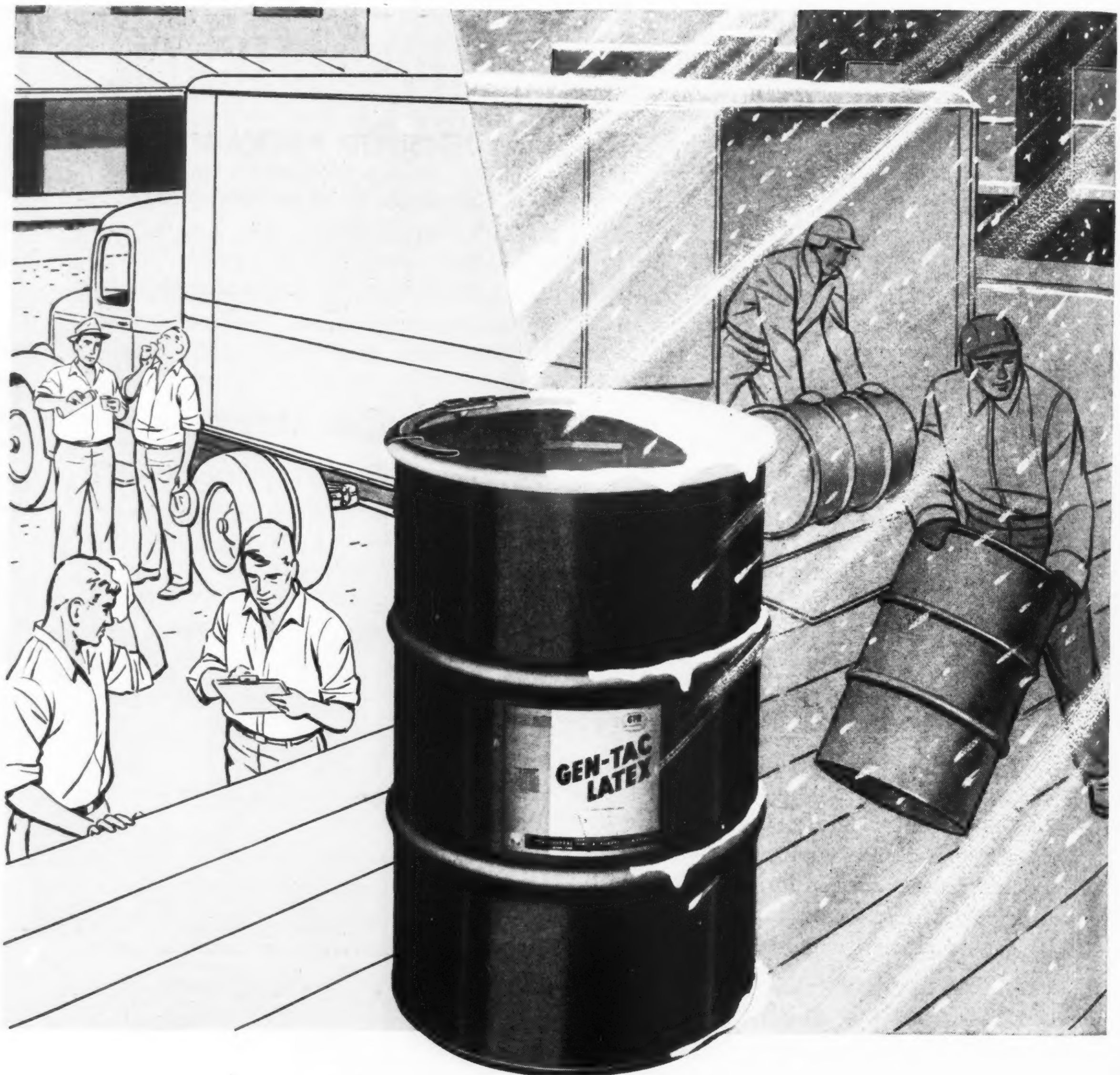
For further information, contact the Pittsburgh Office, Pigment Department

COLUMBIA-SOUTHERN CHEMICAL CORPORATION
SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY
ONE GATEWAY CENTER · PITTSBURGH 22 · PENNSYLVANIA

COLUMBIA-SOUTHERN

DISTRICT OFFICES: Cincinnati • Charlotte • Chicago • Cleveland • Boston • New York • St. Louis • Minneapolis • New Orleans • Dallas • Houston • Pittsburgh • Philadelphia • San Francisco

Winter's Coming...Switch



KURE-BLEND® MT MASTERBATCH.
50% TETRAMETHYL THIURAM DISULFIDE AND 50% GR-S TYPE RUBBER

- Fast, easy mixing
- Excellent dispersion
- Dust-free
- Accurate weighing

KO-BLEND® I. S. INSOLUBLE SULFUR.
50% CRYSTEX AND 50% GR-S TYPE RUBBER

- Controls sulfur bloom
- Eliminates discoloration of light stocks
- Insures good dispersion
- Cuts milling time

to Freeze-Stabilized GEN-TAC* Latex

We are proud to announce another first of real significance to the rubber industry . . . Freeze Stabilized Gen-Tac Latex. Through this important development, it is now possible to make shipment of Gen-Tac in temperatures down to 0°F. If the Gen-Tac is frozen by exposure to such temperatures, it will recover to its normal state upon thawing.

Our Research Laboratories have had drums of Freeze Stabilized Gen-Tac stored in the open continuously since September, 1952. The Latex is in perfect condition, and the bonding strength is as high today as that of freshly made Gen-Tac which has not been stabilized.

No change has been made in Gen-Tac other than the incorporation of the unique stabilization system, so Freeze Stabilized Gen-Tac may be used as a replacement for, or interchangeably with standard Gen-Tac. It has been thoroughly tested by our Tire Development Department and is now being used as standard production material.

General's Gen-Tac offers the additional exclusive advantage of freeze-stabilization at no added cost. For further information on Freeze Stabilized Gen-Tac or other General Tire Chemical Products, just fill out the coupon below.

*T. M. G T & R Co.

Creating Progress Through Chemistry

Chemical Division
GENERAL
THE GENERAL TIRE & RUBBER CO.

GEN-TAC

The General Tire & Rubber Company, Chemical Div.,
1708 Englewood Ave., Akron 9, Ohio

Send literature on ☐ Gen-Tac
☐ Ko-Blend ☐ Kure-Blend

Send sample of
☐ Gen-Tac ☐ Ko-Blend ☐ Kure-Blend
☐ Have your representative call

NAME ____________

COMPANY ____________

STREET ____________

CITY ____________

STATE ____________

RW-11-54

Close harmony

America's rubber industry is remarkable for the close harmony among research scientists, engineers, executives and production managers on many levels.

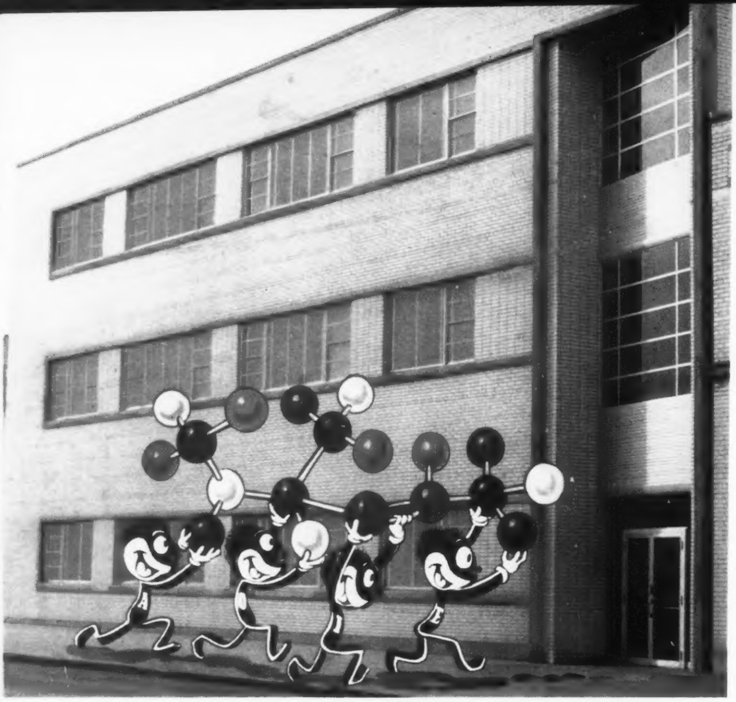
In just a few years this cooperation has completely transformed rubber technology.

Equations jotted in laboratory notebooks have been pilot-tested, evaluated and built into efficient processing units.

Chemicals once available only by the gram at high cost are now produced by the ton at pennies per pound because these chemicals contribute in some way to the efficiency of a rubber compound.

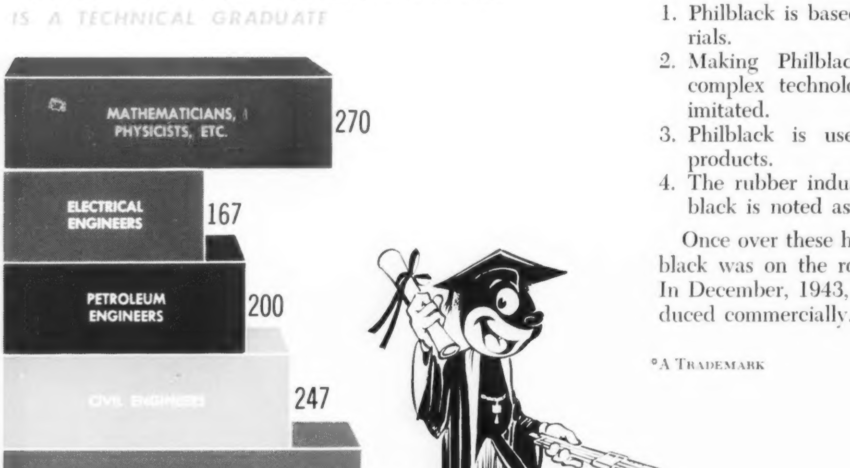
Today the rubber industry is such a dynamic consumer of scientific results and research information that we want to tell you more about Philblack's background in pure and applied science.

PHILLIPS CHEMICAL COMPANY ***Philblack Sales Division***
A SUBSIDIARY OF PHILLIPS PETROLEUM COMPANY



PHILBLACK SALES SERVICE LABORATORY, 312 Water Street, Akron, Ohio, is widely known in the rubber industry as the repository of much of Phillips extensive background in the rubber compounding field. Satisfactory end use for the Philblacks is the goal of this laboratory which calls freely on nine Phillips laboratories and pilot plants in Bartlesville, Oklahoma, and Borger, Texas.

ONE OF EVERY EIGHT PHILLIPS EMPLOYEES IS A TECHNICAL GRADUATE



Philblack* is one in 500,000

About half-a-million different petrochemicals can be synthesized from the molecular building blocks found in crude oil and natural gas.

From this vast array of possible products, Phillips research scientists selected an oil furnace black later known as Philblack for a thorough evaluation.

At that time, Philblack was little more than a gleam in the eyes of a few dedicated researchers. But Philblack had what it takes to meet the four requirements by which Phillips screens promising research ideas:

1. Philblack is based on petroleum raw materials.
2. Making Philblack involves difficult and complex technology which is not readily imitated.
3. Philblack is used in mass consumption products.
4. The rubber industry to be served by Philblack is noted as a growth industry.

Once over these hurdles, the first oil furnace black was on the road to commercial reality. In December, 1943, Philblack A was first produced commercially. Known as High Modulus

*A TRADEMARK

WITH WELL OVER 2,700 SCIENTISTS and engineers in a total working force of more than 22,000 employees, Phillips Petroleum Company and its subsidiaries are well equipped to transform petroleum raw materials into useful, economical products such as the Philblacks.

BEHAVIOR *of highly reinforcing blacks in rubber is investigated from many angles in Phillips laboratories. Specific surface area and particle size have long been recognized as important factors in improving reinforcement. But to evaluate the influence of various physical properties that are almost completely interdependent requires a high level of scientific resource and ingenuity.*

Furnace Black, Philblack A later took its present identification, Fast Extrusion Furnace.

"Well, that's that!" you might have expected our researchers to say as they embalmed Philblack A in research reports and went on to other matters.

But World War II was then upon us. The Philblack process offered such economies in steel, man power and raw materials that our research was continued with increased vigor.

In contrast to most chemical engineering development, Philblack research used full-scale commercial reactors. This is unusual. It calls for great skill. Operating costs on a full-scale "pilot" plant can reach incredible levels. Yet, by systematically studying combustion variables in a full-size unit, Phillips researchers accumulated data which translated readily into an entirely new High Abrasion Furnace black – Philblack O.

Introduction of Philblack O touched off an eightfold expansion in Philblack plant capacity. The rubber industry called for Philblack with such insistence that it was years before we could build up the Philblack inventories which are now maintained.

Following 1947, slide rules ran hot and heavy for many months as our chemical engineers designed and constructed the world's largest furnace black plant at Borger, Texas. With this pressure for production you might logically anticipate a let-down in research on carbon black.

Such was not the case. Phillips research reports of the period bristle with new ideas.

Higher structure . . . greater reinforcing potential . . . balanced with useful processing properties and realistic economics – such were our research goals in carbon black.

On October 6, just 2 years ago, the toughest carbon black ever marketed commercially came on the scene. Philblack E Super Abrasion Furnace, as this black is known, exhibits extreme resistance to abrasion. It sturdily withstands aging, cracking, cutting and chipping.

Most recently, Philblack I – Intermediate Super Abrasion Furnace black – has emerged from Phillips pilot plant. Philblack I combines superior abrasion resistance with the economic advantages of a less expensive black.

With four aces in hand – four Philblacks – you may wonder if our research still proceeds on carbon black.

Indeed it does.

New aspects of surface chemistry and solid state physics are being examined by critical and imaginative minds.

The more we learn about carbon-polymer interaction, the more Philblack will be able to help you of the rubber industry to deliver better rubber products at lower costs.

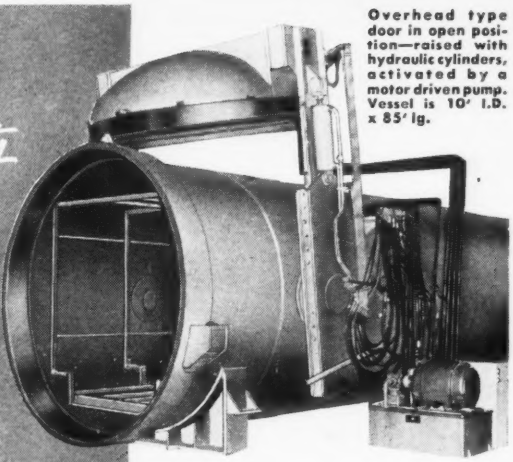
RADIOACTIVE SUBSTANCES *are removed from the Materials Testing Reactor at Idaho Falls, Idaho, where Phillips research scientists manage and operate various activities for the Atomic Energy Commission. Although the functions at Idaho Falls are strictly classified, the known function of this reactor is expected to develop design criteria for the use of materials under exposure to radioactivity.*

STRUTHERS WELLS

Patented Engineering Achievements

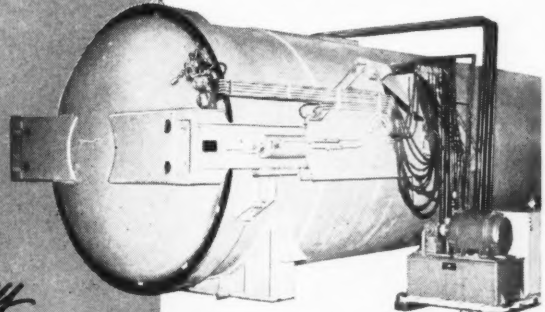
provide important advancements in

QUICK OPENING DOORS



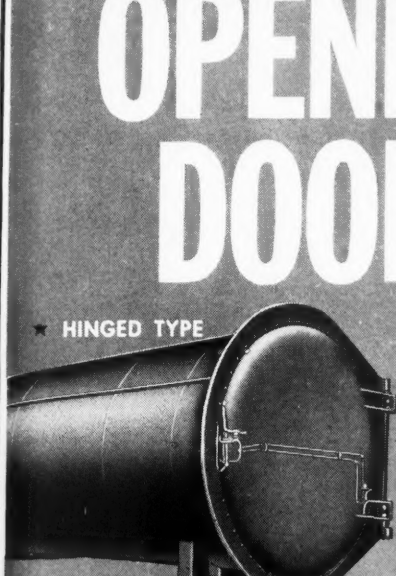
Overhead type door in open position—raised with hydraulic cylinders, activated by a motor driven pump. Vessel is 10' I.D. x 85' lg.

Same 10' dia. vessel as above, with door in closed position.



★ OVERHEAD TYPE

★ HINGED TYPE



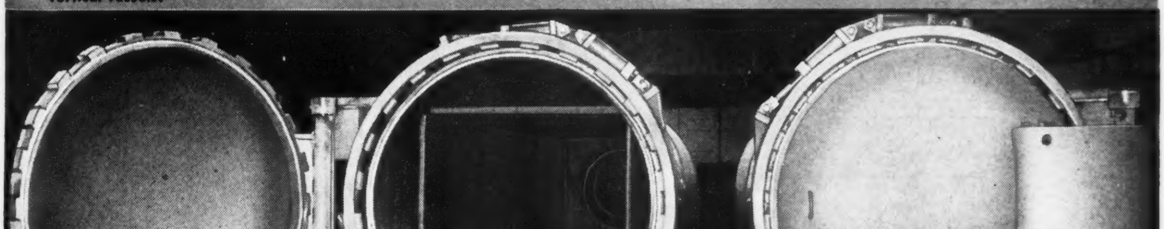
Shown above is a hinged type door which is mounted on anti-friction bearings and is manually operated.

...for every industry

Complete simplicity of operation, ease in handling, faster opening and closing, important saving of floor space, and a lifetime of dependability are some of the outstanding features of Struthers Wells Quick Opening Doors—for every industry. Investigate these engineering achievements for your Quick Opening Door applications.

★ LUG TYPE

Shown below in open and closed position, the lug type door can be provided for horizontal or vertical vessels.



Consult Struthers Wells for Quick Opening Doors best suited to your specific requirements.

STRUTHERS WELLS CORPORATION

Process Equipment Division • **TITUSVILLE, PA.**

Plants at **TITUSVILLE, PA.** • **WARREN, PA.** • *Offices in Principal Cities*

2 NEW STABILIZERS FOR VINYL GARDEN HOSE

- SPARKLING CLARITY
- IMPROVED WEATHERING
- OUTSTANDING HEAT STABILITY

MARK M
OR
MARK XV

Both stabilizers are in convenient liquid form . . . mix readily with all plastic formulations. Both are lower in cost than any other stabilizers of comparable advantage.

If the vinyls you produce require these important characteristics, now is the time to investigate Mark M or Mark XV Stabilizers. *Write today for Technical Bulletin 11.*

"PURR-FECTION"

ARGUS CHEMICAL CORPORATION
633 COURT STREET BROOKLYN 31, N. Y.

TANNEY-COSTELLO
INCORPORATED

NATURAL & SCRAP RUBBER
—
PLASTICS & SYNTHETICS

P. O. BOX 1112
868 E. TALLMADGE AVE., AKRON 9, OHIO

REPRESENTATIVES FOR:

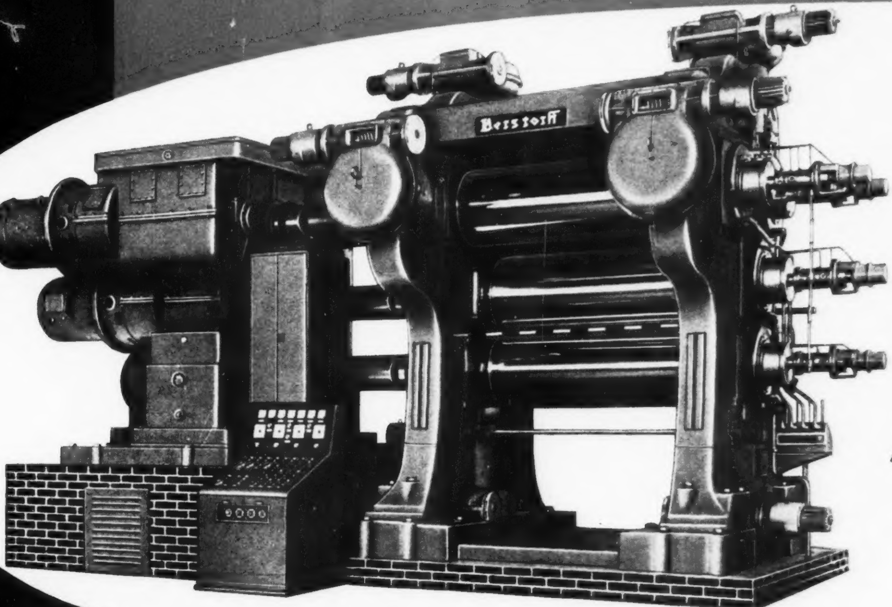
S. J. PIKE & CO., INC.

Rubber — Natural and Synthetic
30 CHURCH STREET, NEW YORK 7, N. Y.

Berstorff

CALENDERS

FOR RUBBER AND PLASTICS



Roll size: 1800 mm. face width x 700 mm. diameter. (71'' x 27½'')

Outstanding features:

1 Running speed infinitely variable over 10:1 range. Friction ratio also infinitely variable from 2:1 to even speed. Reliable synchronisation control.

2 Absolutely uniform distribution of load on the rolls because neither motors nor gears are carried by the roll necks. Universally jointed drive shafts also give many other important advantages.

3 Axes of rolls can be crossed while calender is running.

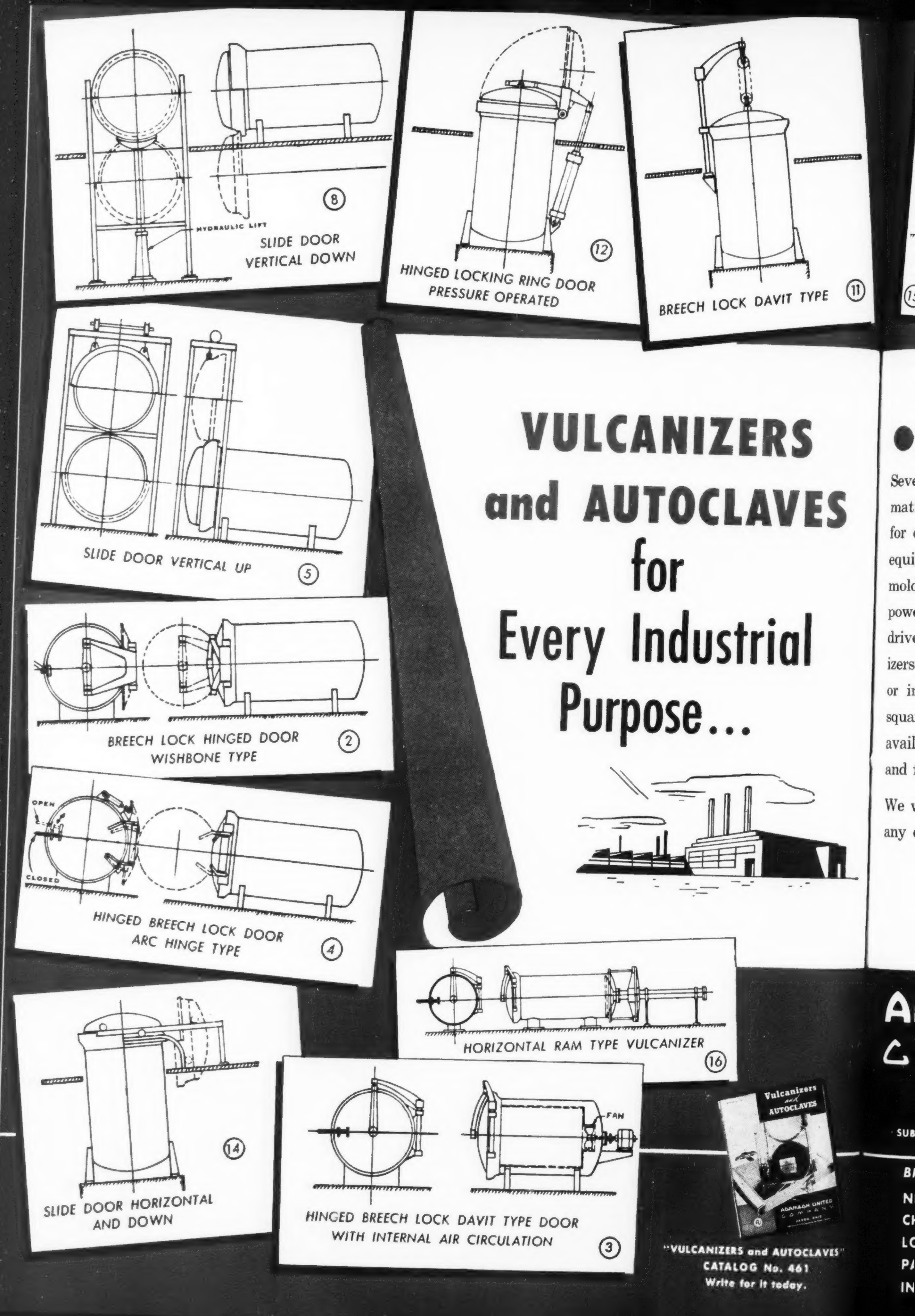
We can supply complete installations for the production of film and sheet. The auxiliary equipment is driven by individual variable speed D. C. motors. Further information available with pleasure on request.

HERMANN

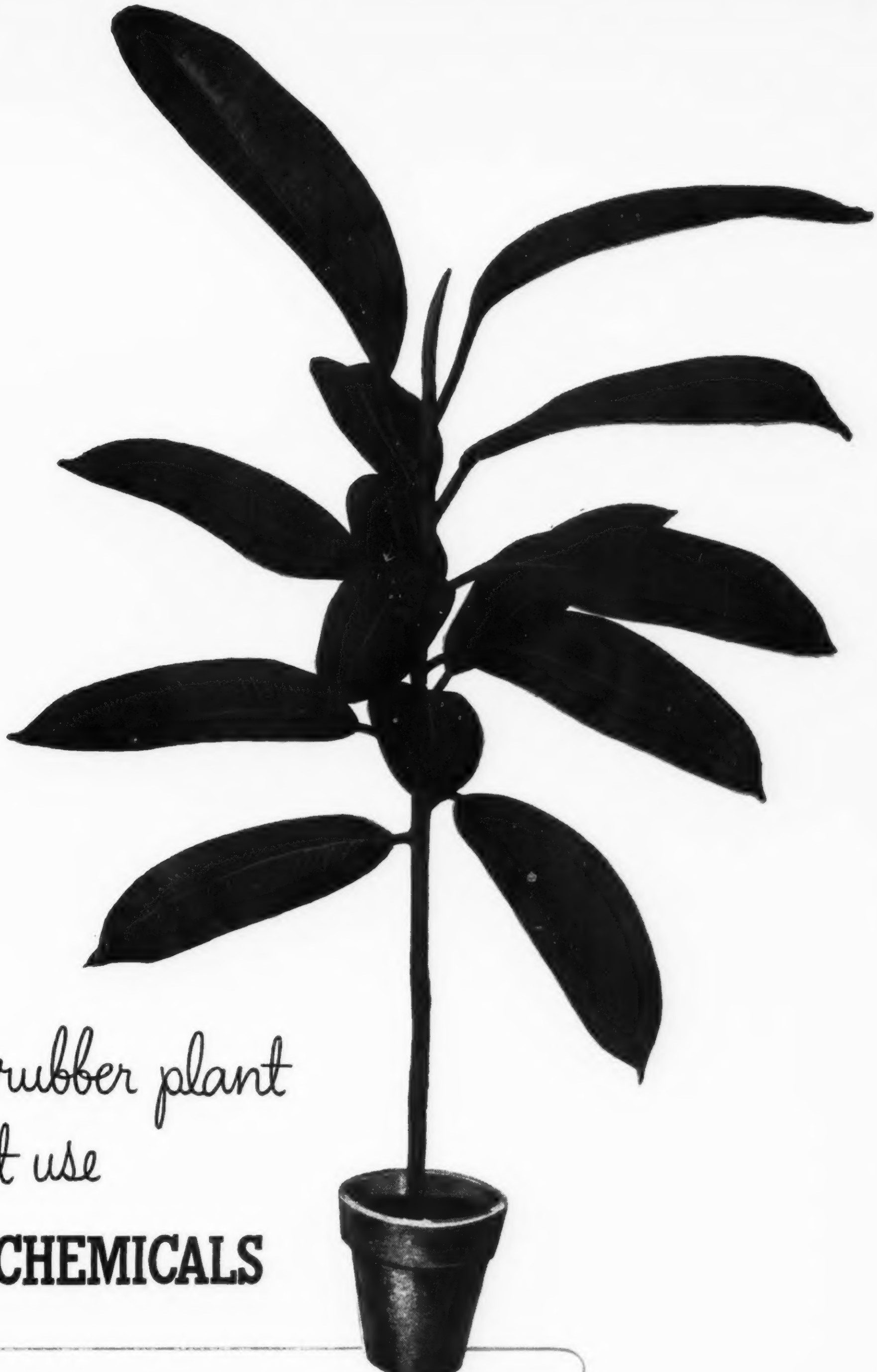
Berstorff

MASCHINENBAU-ANSTALT GMBH · HANNOVER

Factory Representative: **TRANSMARES CORPORATION** 15 WILLIAM STREET, NEW YORK, 5, NEW YORK



HYDRAULIC LIFT
SLIDE DOOR VERTICAL DOWN
8
HINGED LOCKING RING DOOR PRESSURE OPERATED
12
BREECH LOCK DAVIT TYPE
11
SLIDE DOOR VERTICAL UP
5
VULCANIZERS and AUTOCLAVES for Every Industrial Purpose...
BREECH LOCK HINGED DOOR WISHBONE TYPE
2
OPEN
CLOSED
HINGED BREECH LOCK DOOR ARC HINGE TYPE
4
HORIZONTAL RAM TYPE VULCANIZER
16
SLIDE DOOR HORIZONTAL AND DOWN
14
FAN
HINGED BREECH LOCK DAVIT TYPE DOOR WITH INTERNAL AIR CIRCULATION
3
Vulcanizers and AUTOCLAVES
"VULCANIZERS and AUTOCLAVES" CATALOG No. 461
Write for it today.



TAYLOR ANNOUNCES A

NEW "ROBOT BRAIN"!

*The new Taylor Flex-O-Timer**

TIMED PROGRAM CONTROLLER

DESIGNED primarily for application to automatic presses used in the rubber industry, the FLEX-O-TIMER Timed Program Controller gives greater than ever precision to the timing and coordination of automatic tire vulcanizers where simple and precise settings are required. Settings can be readily changed to accommodate different tire sizes, to switch from nylon to rayon cord, or for variations in compounding. It will actuate switches, turn valves and perform many other operations involving temperature, pressure, mechanical motion, electrical energy or any combinations of these . . . and perform each function in exactly the same way time after time. Handles automatically from one to eight electrically or pneumatically operated functions.

INCREASED SETUP SPEED

The greatest advantage of this new instrument is that it makes possible direct time settings, for greater accuracy, speed and convenience. Program trip pins are manually positioned to the exact time at which a function is to be operated . . . these settings are duplicated in the step mechanism by means of latch trip pins set into corresponding notches. Result — no operator computations necessary, precision of settings.

MANY PLUS VALUES

1. Time dial automatically resets to zero in maximum of 13 seconds on completion of cycle.

2. Time cycle from 3 minutes to 4 hours available.

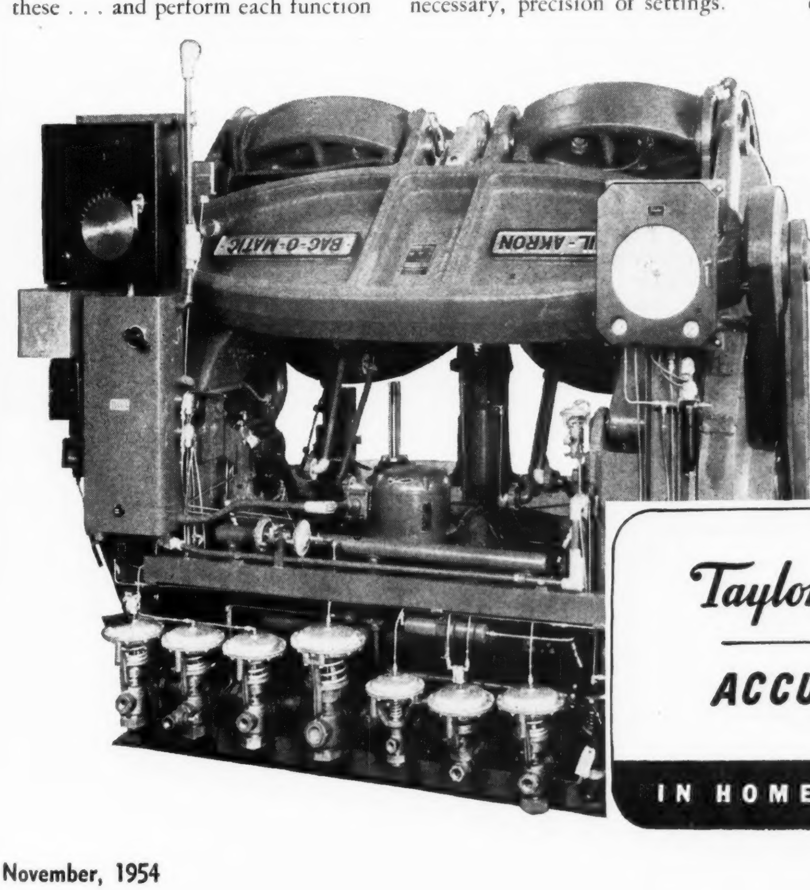
3. Minimum time between program trip pins—7½ seconds on 30 minute cycle dial.

4. Step disc provides 20 positions for mounting "off" or "on" cams to actuate up to 8 pneumatic or electric latch operated functions.

5. Duration of an operation may be timed to a minimum of 1½ seconds.

6. All zero-start position functions actuated within 1½ seconds from time start.

Ask your Taylor Field Engineer for full information about this new instrument, or write for **Catalog 98350.** Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.



Back view of Bag-O-Matic press showing new FLEX-O-TIMER Timed Program Controller (left), FULSCOPE Controller (right).*

*Reg. U.S. Pat. Off.

Taylor Instruments

MEAN

ACCURACY FIRST

IN HOME AND INDUSTRY

RUBBER WORLD

A Bill Brothers Publication

Formerly

INDIA RUBBER WORLD

NOVEMBER, 1954

Vol. 131—No. 2

Table of Contents

Departments

Market Reviews

Statistics

SUBSCRIPTION PRICES
United States, $5.00 per year; Canada, $6.00; all other countries, $7.00. Single copies in the U. S., 50¢; elsewhere, 60¢.

Other Bill Publications are: In Marketing, SALES MANAGEMENT, SALES MEETINGS, PREMIUM PRACTICE. In Merchandising, FLOOR COVERING PROFITS, FOUNTAIN & FAST FOOD, GROCER-GRAPHIC, TIRES — TBA Merchandising, YANKEE FOOD MERCHANT.

Published monthly by

BILL BROTHERS PUBLISHING CORPORATION

Editorial and Executive
386 Fourth Ave.
New York 16, N. Y.
LExington 2-1760

Office of Publication
1309 Noble St.,
Philadelphia 23,
Pennsylvania

Chicago Office: 333 N. Michigan Ave., STate 2-1266

B. BRITTAIN WILSON, *General Manager*
ROBERT G. SEAMAN, *Editor*
S. R. HAGUE, *Managing Editor*
ARTHUR M. MERRILL, *Associate Editor*
MORTON ZELENKO, *Assistant Editor*
ROBERT C. TOTH, *Contributing Editor*
RUFUS H. FAIRCHILD, *Advertising Manager*
M. J. McCARTHY, *Circulation Manager*
M. A. LARSON, *Production Manager*

Chairman of Board and Treasurer
RAYMOND BILL

Vice Presidents
B. BRITTAIN WILSON
C. ERNEST LOVEJOY
WM. H. McCLEARY

President and General Manager
EDWARD LYMAN BILL

RUBBER WORLD

Vol. 131—No. 2 November, 1954

Editorials

Synthetic Plant Disposal Must Be Accomplished in 1955

BECAUSE of the necessary condition of secrecy in which the Rubber Facilities Disposal Commission has had to conduct its negotiations for disposal of the government-owned synthetic rubber plants, lack of knowledge of the progress of these negotiations has created the impression in some quarters that there has been very little progress and that the chances of disposal are not good.

Then, too, there is the very real problem of the political climate in the next Congress in early 1955 when the Disposal Commission's recommendations, if favoring disposal, must be approved or rejected. Much has been said concerning the smaller chance for Congressional approval of Disposal Commission recommendations if one or both Houses of Congress should have Democratic majorities, but there are many reasons why this preconceived notion may be wrong.

RUBBER WORLD and most of the industry it serves have been most anxious for the time to come when the basic precept of the Rubber Act of 1948, and its extensions, that as a matter of national policy the government should turn the synthetic rubber industry over to private enterprise, could be realized. The late Rep. Paul W. Shafer emphasized most strongly last fall that the primary responsibility for successful disposal now rests with the members of private industry who want to buy the plants. He went on to predict that the alternative was permanent socialization of synthetic rubber production.

Although only about one-third of the prospective buyers are companies in the rubber industry, we believe that other companies in the chemical and petroleum industries will do just as much as the rubber companies in trying to make the disposal program a success. It is considered quite likely that if the Congress will be satisfied with the $350 million figure stated by the late Representative Shafer as representing a "fair return" to the taxpayers, such a figure will be found in the Disposal Commission's recommendations to Congress on February 1, 1955.

We do not feel that the majority of any future Congress, Republican or Democratic, really wants to take the responsibility for permanent socialization of all or part of the rubber industry. Congress must be reminded again and again of this danger, however, since there is a significant minority that leans toward such socialization or nationalization of industry.

One of the main concerns of the Congress in connection with disposal legislation will be the national security aspect, but the outlook for world peace has never been better and is likely to remain that way in the foreseeable future. In addition, we have a more than adequate natural rubber stockpile if trouble should develop.

Even if war clouds should appear on the horizon, why should the synthetic rubber industry have to continue under government ownership and control any more than the steel, automotive, or aircraft industries? Private industry could and would provide satisfactory production and distribution of synthetic rubber under Federal supervision.

Then there is the present-day political unpopularity of programs resulting in the sale of government-owned property to private industry, no matter how well conceived the program may be. It is difficult to see how in the light of the existing situation in connection with the disposal program that many Congressmen could be concerned about any "give-away" aspects of the synthetic rubber plant disposal program as it will eventually emerge. If Congress insists on holding out for unreasonably high prices for the plants, the responsibility for keeping the government in the rubber business will be that of the legislative branch.

Disposal must be accomplished in 1955 for another reason most important to the Congress and the taxpayers. It is not inconceivable that if the government stays in the synthetic rubber producing business, private industry may build with its own funds modern plants of its own design, that may not only be able to compete successfully with the government plants, but may render the latter obsolete in the course of a relatively small number of years.

Finally, a continuing government research program on synthetic rubber to insure special Armed Services requirements, after disposal, now seems assured.

R. G. Seaman

How Synthetic Rubbers Affect You[1]

By **Ian D. Patterson**[2]

CONTINUED production of synthetic rubbers is indicated as necessary for progress.

Tough, high molecular weight polymers, made usable by masterbatching with oil, have proved their superior quality and economy by three years' increased application on a large scale. The Olsen flow tester is an old machine with a new application for selecting better polymers.

High solids butadiene/styrene copolymer and butadiene polymer latices have improved in quality so that they can be used in larger amounts for foamed rubber products.

Medium and low solids butadiene/styrene latices have been successful as base ingredients for adhesives and paints.

Types of agitation, reactors, concentrators, heat exchangers, batch and continuous polymerization have been important contributions in the chemical engineering phase of the synthetic rubber program.

YOU live in a world of feast and famine. These contrasts are with us every day in your land and mine. War and peace, cold and hot, change the emphasis.

During the last decade, synthetic and natural rubbers have been both abundant and scarce. Ten years is a short time to compare with the period since Christopher Columbus found American Indians playing with rubber, or since organized scientific rubber research began as connected with such men as Priestley, Charles Goodyear, and Sir Henry Wickham. It appears long enough, however, to establish synthetic rubbers as essential for large-scale use in a better world and an expanding economy. If someone were not using synthetic rubber, you could not make so many products from natural rubber and *vice versa.*

This paper presents three main features: (a) the economic necessity of both synthetic and natural rubbers; (b) description of a physical test as a new means for selecting better polymers; and (c) synthetic and natural rubber latices as used in foamed rubber products.

Consumption Demands Production

Consumption of new rubber is the overall measure of achievement in this field. It completes the cycle of creative production. It correlates with industrial development and standards of living.

You are affected not only by what you produce and consume, but also by the corresponding efforts of others.

Figure 1 shows new rubber consumption was one pound per person in the U. S. A. during 1900. The same figure applies in the balance of the world today. Now the U. S. A. consumption figure is 19 pounds per person, compared to a few ounces in China.

The rate of increase in rubber use is greater in the rest of the world than it is in the U. S. A.

Today total consumption of new rubber is almost double that of prewar; whereas world supply of natural rubber has remained almost stationary.

Figure 2[3] depicts consumption of all new rubber since 1940 and an estimate for the future. In 1953, world consumption of new rubber was at a rate some 600,000 tons in excess of total supply of natural rubber. Thus supply of natural rubber alone is inadequate for current necessity and continued economic progress. Also synthetic rubber all alone, as made in present plants, is not capable of serving elastomer requirements.

[1] Presented before the Third Rubber Technology Conference of the Institution of the Rubber Industry, London, England, June 22, 1954.
[2] Goodyear Tire & Rubber Co., Akron, O.
[3] U.S.A. government and Goodyear statisticians, Figures 2-7.

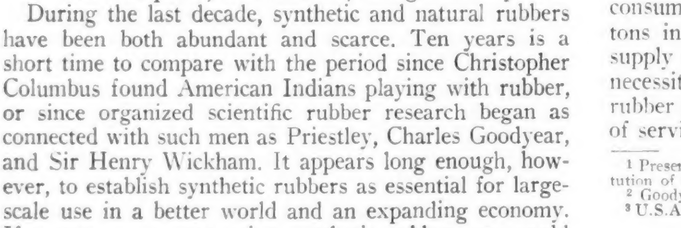


Fig. 1. New Rubber Consumption—Worldwide; Includes per Capita Consumption and the % of the World Consumption Occurring in the U.S.A.

Fig. 2. World Rubber Consumption, Both Natural and Synthetic, with Estimates for 1960 and 1975

Source: (a) U. S. Government; (b) Statisticians Office, Goodyear; (c) Paley Commission

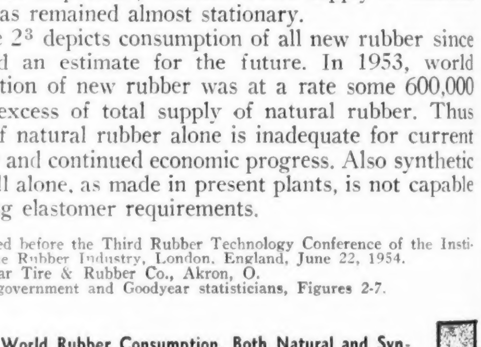


TABLE 1. U. S. NATURAL AND SYNTHETIC (BY TYPE) CONSUMPTION—BY YEAR 1947-1957*

(Thousands of Long Tons and % of Total)

(Net plus Oil)

Period Calendar Year	Dry Natural Rubber LT	Dry Natural Rubber %	Natural Rubber Latex LT	Natural Rubber Latex %	U. S. Synthetic Rubber: GR-S LT	GR-S %	Butyl LT	Butyl %	Neoprene LT	Neoprene %	N-Type LT	N-Type %	S-Type LT	S-Type %	Total Synthetic LT	Total Synthetic %	Total Natural and Synthetic
1947	549	49	14	1	446	40	69	6	38	3	5	1	2	–	560	50	1,123
1948	599	57	28	2	334	32	55	5	32	3	6	1	4	–	431	41	1,058
1949	539	55	36	4	299	31	51	5	32	3	9	1	6	1	397	41	972
1950	664	54	56.1	4	389	32	61.4	5	43.8	3.6	11.9	1	7.1	0.6	513	42	1,233
1951	407	34	46.8	4	†617	51	68	6	48.9	4.1	13.1	1.1	1.5	0.1	749	62	1,203
1952	401	32.4	53.4	4.3	648	52.3	68.7	5.5	54.5	4.4	13.7	1.1	0.2	–	785	63.3	1,240
1953‡	485	36.3	66.8	5	623	46.6	80	6	64	4.8	16	1.2	2	0.1	784	58.7	1,336
1954‡	526	40.2	73	5.6	554	42.3	78	6	62	4.7	16	1.2	–	–	710	54.2	1,309
1955‡	505	36	45	3	680	48.4	95	6.8	64	4.6	16	1.1	–	–	855	61	1,405
1956‡	510	35.5	45	3	700	49	100	7	66	4.6	16	1.1	–	–	882	61.4	1,437
1957*	510	35	45	3	720	49.3	100	6.9	68	4.6	17	1.2	–	–	905	62	1,460

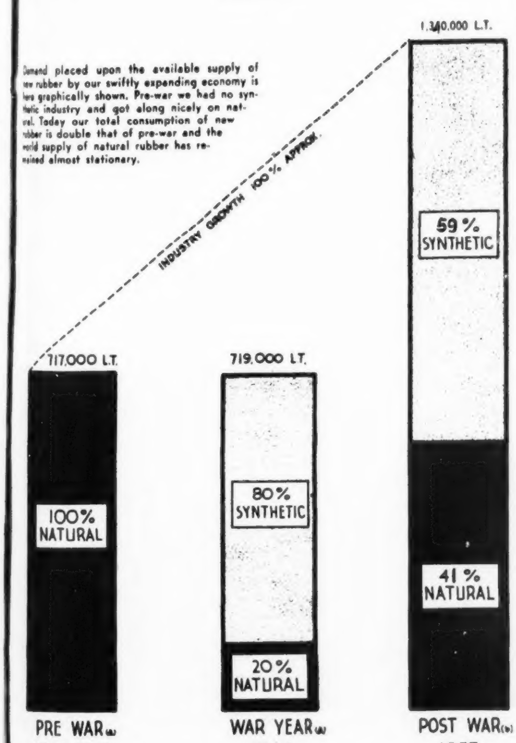
*Source: U. S. Department of Commerce and The Rubber Manufacturers Association, Inc. Consumption of imported synthetic rubber not included, (approx. 10,000 LT per year). Prepared 7/23/52 (LES); revised 12/8/52 (EDK); revised 11/24/53 (EJVP); not revised beyond 1954.

†Oil in the amount of 5,770 LT to be added.

‡Estimated.

Figure 3[3] and Table 1 portray U. S. A. new rubber consumption in recent years. Types used were influenced by availability during war periods. Synthetic rubber research, development, and production have been intensified when there has been a shortage of natural rubber. A planter of natural rubber has to wait seven years or more in order efficiently to tap and harvest his rubber.

Fig. 3. New Rubber Consumption (Long Tons) in the United States during Recent Years. Demand Placed upon the Available Supply of New Rubber by Our Swiftly Expanding Economy Is Graphically Shown. Prewar We Had No Synthetic Rubber Industry and Got Along Nicely on Natural Rubber. Today Our Total Consumption of New Rubber Is Double That of Prewar, and the World Supply of Natural Rubber Has Remained Almost Stationary



Source: (a) U. S. Government; (b) Statisticians, Goodyear

With the proper coordination of all forces, synthetic rubber can be produced within a year or two.

In Figure 4[3] and Table 1 the consumption curves of natural and synthetic rubber in the U. S. A. have crossed each other in 1943, 1947, and 1950. Another cross appears imminent in 1954. An approximate 50/50 ratio of natural to synthetic rubber consumption has been attained in such areas as the U. S. A., where raw materials for synthetic rubber are available commercially. This balance is influenced by price and technical considerations.

Figure 5[3] presents the New York spot prices of natural and synthetic rubbers.

The last of 1953 was a period in which the prices of natural and general-purpose synthetic rubber were ap-

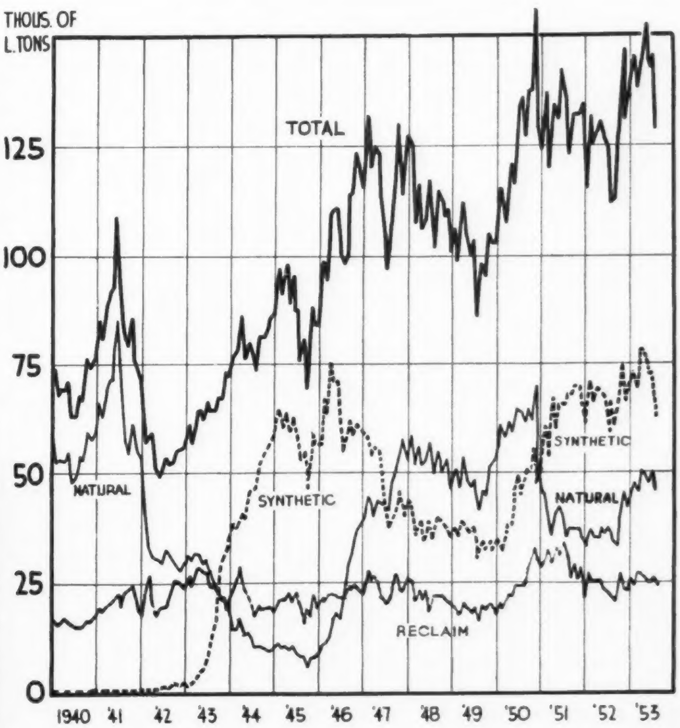


Fig. 4. Romance of Natural and Synthetic Rubber. U.S.A. Consumption on a Monthly Basis. Note That the Curves Have Crossed Each Other in 1943, 1947, and 1950

proximately in balance, and ample supplies of both were available. In such a situation with free economy and present knowledge the overall percentage of each used depends mainly on price.

Use in end-products depends on development and needs of a country. In the U. S. A., where consumption of new rubber per person is high, the distribution by major product groups is shown in Figure 6.[3]

Quality demands in some products allow a premium to be paid when necessary for certain grades and types of rubber. For instance the price of natural rubber would have to be very much lower than synthetic to justify use in quality wire and cable and certain industrial products (1).[4] On the other end of the scale, at the present time, natural rubber can be more than double the price of synthetic rubber and still be justified for the carcasses of large truck and bus tires (2). With the advance in the chemistry and technology of synthetic rubber this condition may not exist always.

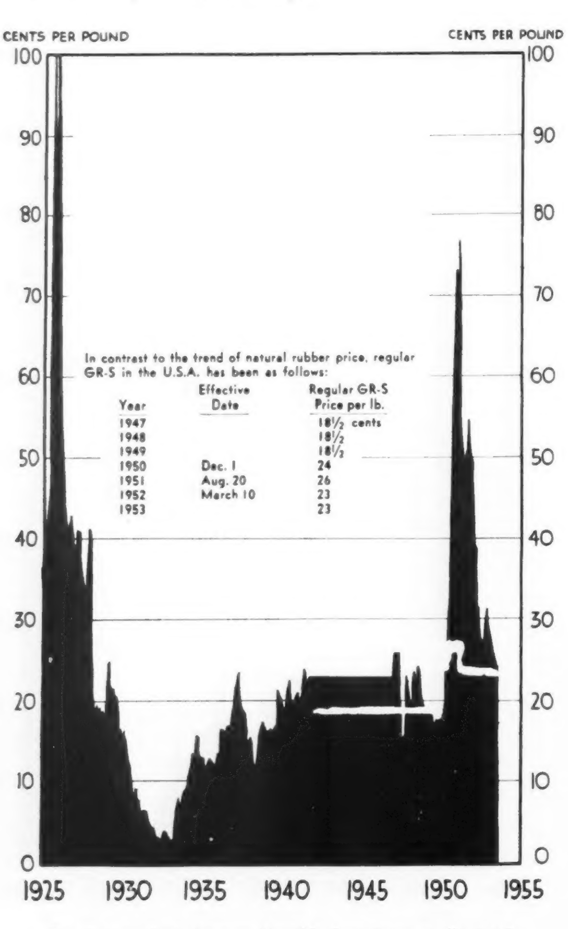


Fig. 5. New York Average Monthly Spot Price of #1 R.S.S. Natural Rubber

These exemplify the close association of applied science and economics. The direction of fundamental research is often affected by future economical applications.

High Molecular Weight Polymers Enriched with Oil

An instance whereby technical superiority and cost have influenced use is demonstrated by uniform, high molecular weight polymers made processable by various oils.

During 1950 and 1951 a demand arose for a greater quantity and a higher quality rubber. The Korean conflict provided the impetus. The vast reservoir of fundamental knowledge (2-6) acquired during previous years was tapped. Tough, high viscosity, high molecular weight polymers were constructed. Emulsified petroleum oils mixed with their latex made the polymers practical for use.

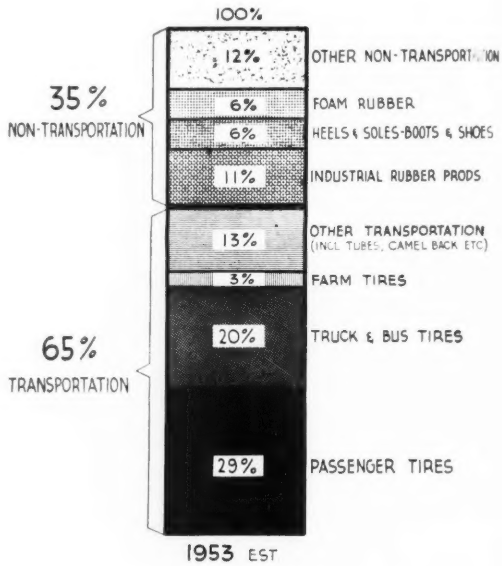


Fig. 6. U.S.A. New Rubber Consumption by Major Product Groups

Within limits, greater sorption of oil is obtained with higher molecular weight, while resistance to tire tread abrasion is maintained. A wide variety of naphthenic and aromatic petroleum oils has been found suitable (4).

An assembly of results (2) from 40 road tests of tires built with compounding procedures of various companies indicates 25 parts oil-cold rubber masterbatch is 5% better than standard cold rubber in tread wear. Also, from 12 road tests, the 37½ parts oil-cold rubber masterbatch is approximately equal to cold rubber in tread wear. Based on 22 road tests, the 50 parts oil masterbatch is equal in tread wear to 37½ parts oil masterbatch.

Average characteristics of base polymers and masterbatches with these ratings are shown in Tables 2 and 3.

The road test results quoted above are an average from many different makes of tires with varying compounding formulae and processing procedures. Repeated tests of tires made by a single manufacturer (5) have demonstrated oil masterbatch tire treads are capable of 15 to 21% better tread wear than cold rubber treads.

The value of the oil masterbatch has been shown by increased use in a relatively short period of three years. Tire treads, shoe applications, and industrial products have been the main outlets for this high quality, lower cost elastomer. Table 4, column 5, (10) presents the story of its growth.

The Olsen Flow Test

The Mooney viscosimeter has been a very valuable tool for measuring polymers. It has been standardized and universally applied in synthetic rubber manufacture and use. It has been an excellent measure of plasticity for polymers having a rating below 120 on its scale with

[4] Numbers in parentheses refer to Bibliography items at end of article.

the large rotor (M/L-4 at 212° F.). Ratings up to M/L 160 are possible, but become unreliable in the upper range. Ratings of 40 to 70 M/L-4 have been allied with large-volume uses in factories.

TABLE 2. COMPARISON OF OIL-COLD RUBBER MASTERBATCHES

GR-S Types	°F. Temp. Polymerization	Base Mooney ML-4	% Conversion	Final Masterbatch: Parts Oil per 100 Polymer	Final Masterbatch: Mooney M/L
GR-S 1500	41	55	60	—	—
GR-S 1700, GR-S 1703	41	110	60	25	55-60
GR-S 1710	41	120	60	37.5	55
GR-S X-692	41			40	
Polysar Krynol†	55	135	70	42	54
GR-S X-661, GR-S X-709, GR-S X-721	41	150	60	50	55
GR-S X-690	41	160	60	60	55

*See Bibliography, (7).
†Polymer Corp., Ltd., Sarnia, Ont., Canada.

to 3,000 p.s.i., 212 to 384° F.; dimensions of cylindric pellet sample, approximately 3/8-inch diameter by 3/8-inch in height.

As the material under test flows up into the orifice, the recorder plots flow against time. The result is the distance of flow in inches for a two-minute period as read directly from the chart.

The instrument is used for many other materials such as resins and plastics.

Correlation of Olsen Flow with Adhesion

The Olsen Flow test has helped select better polymers for stronger adhesion to such materials as nylon and rayon. Table 5 presents these data.

Correlation appears among adhesion strength, Olsen flow plasticity, and the quantity of mercaptan modifier used in making the polymer. No reliable correlation exists between Mooney plasticity and these properties for this tough type of polymer.

TABLE 3. MOLECULAR WEIGHTS AND SOL-GEL PROPERTIES OF CERTAIN PRODUCTION GR-S RUBBERS*

Polymer No.	Parts Oil	% Conversion	Parts Mercaptan per 100 Monomers†	$M_n \times 10^{-3}$ Calc'd from RSH‡	$M_n \times 10^{-3}$ Osmotic Pressure§	Gel (%) ¶ in Polymer Hydrocarbon	Polymer Hydrocarbon DSV	$M_v \times 10^{-3}$ Calc'd from DSV‖
GR-S-1006	—	71	0.403 n-DDM	50.5	69	1	2.22	286
GR-S-1500	—	**60	0.16-0.22 Sulfole B-8 or MTM	72.5-100		0	2.2-2.4	282.5-322
GR-S-1502	—	65	0.172 Sulfole B-8	100	110	1	2.12	267.5
Polysar Krynol (55° F.)	45	**70				7	3.58	585
GR-S-1700(X-628)	25	65	0.106 Sulfole B-8	162	155	0	3.11	474
(X-693)	25	68	0.112 Sulfole B-8	161	150	2	2.71	386
GR-S-1710 (X-706)	37.5	**60	**0.088 Sulfole B-8	182		4	3.06	463
X-709	50	**60	0.076 Sulfole B-8	211		0	3.78	634
X-721	50	**60				0	3.59	587

*See Bibliography, (7).

†For GR-S-1006, 1502, X-628 and X-693, GR-S-1710, and X-709, the amounts of mercaptan shown are those actually used in making the production polymers on which the data are shown. The amounts of mercaptan required to make any one of the polymers shown actually varies from time to time and from one plant to another.

DDM = Dodecyl mercaptan. MTM = Mixed tertiary mercaptans. Sulfole B-8 = Trade name for tertiary dodecyl mercaptan.

‡M_n calc'd from RSH* = $M_n = \dfrac{20200}{\left(\dfrac{\Delta R}{\Delta P}\right) R_0}$ where $\dfrac{\Delta R}{\Delta P}$ is ratio of fraction of RSH consumed to fraction of monomers converted.

$$R_0 = \left(\frac{\%S \text{ in RSH}}{15.87}\right) \text{(Parts impure RSH used)}$$ [Bibliography, (7, 8)].

*Based on assumed 80% consumption of mercaptan, a value close to that observed in plant operation. Mercaptan sulfur taken to be 13.9% for n-DDM and 15.0% for Sulfole B-8.

§M_n from osmotic pressure not corrected for cross-linking; the M_n of the primary molecules will be lower than the values shown.

M_n = number average molecular weight.
RSH = mercaptan modifier (n-dodecyl or t-dodecyl in these data).
M_v = viscosity average molecular weight calc'd from DSV.

DSV = dil. sol'n visc.: $\text{DSV} = \dfrac{2.3 \log_{10} \text{(relative viscosity)}}{\text{concentration (g./100 cc. solution)}}$ in which η_r is in range of 1.2-1.4.

¶All gel and DSV values on base polymer pure hydrocarbon using benzene as solvent.

‖M_v calc'd from $[\eta] = 4.9 \times 10^{-4} M^{0.67}$ in which $[\eta]$ = intrinsic viscosity, [Bibliography (9)].
M = molecular weight.

**Approximately.

The small rotor machine has been helpful, but slippage and crumbling tend to give unreliable results in ranges above 65 (M/S-4 at 212° F.).

In order to take advantage of the resilient and abrasion resistant qualities of high molecular weight polymers, the need of another differentiating test has become apparent. The Olsen flow test may bring out distinctions not divulged by other tests.

The Olsen flow tester(11) is pictured in Figure 7. Its main features are described as follows: diameter of orifice, 1/8 inch; pressure and temperature, normal for tests reported, 500 p.s.i. at 212° F., range possible, 100

TABLE 4. U. S. A. DOMESTIC CONSUMPTION OF GOVERNMENT PRODUCED GR-S RUBBER BY YEAR

(Long Tons Dry Weight—Includes Oil, but Excludes Carbon Black)

Year	Total	Hot Solid	Cold Solid	Oil Masterbatch	Hot Latex	Cold Latex
1951	622,970	358,270	211,498	25,666	25,168	2,368
1952	648,816	305,073	231,433	72,278	29,975	10,057
1953*	612,500	182,900	248,000	140,000	26,060	15,540

*Estimated.

Thus, the Olsen flow machine helps select high-quality polymers for strong adhesion with certain tire cords.

TABLE 5. CHARACTERISTICS OF COPOLYMER IN X-617 TYPE LATEX*

Sulfole B-8† Modifier	Mooney M/S-4 @ 212° F.	Adhesion	Olsen Flow In./2 Min.
0.023	86	100	0.24
0.040	96	85	0.39
0.060	91	70	0.45
0.100	68	67	0.69

*A cold GR-S type latex widely used as in cord-to-rubber adhesive compositions.

†Based on parts per 100 monomers used in the polymerization charge.

Special-Purpose Rubbers

Included in the totals of synthetic rubbers produced and consumed are some special-purpose rubbers whose use can be evaluated separately from natural, general-purpose, and Butyl synthetic rubbers.

Neoprene and Nitrile Types of Synthetic Rubber

The record of nitrile and neoprene rubbers is all the more outstanding because of the higher cost of these materials. They have supplied a need, primarily for industrial products, which has not been met adequately by the other rubbers.

Figure 8 presents the production of neoprene and nitrile rubbers since 1941(7). Table 1 includes consumption data for these rubbers. Needs arising from World War II and the Korean war are apparent, but, aside from war uses, expansion of peacetime use is also indicated.

Polyester/Isocyanate Rubbers

New elastomers based on diisocyanate modification of polyesters(12) represent a relatively new type of synthetic rubber. They may well find special fields of their own and help to increase the ever-expanding use of rubber. Since this paper is concerned primarily with the evaluation of synthetic rubbers currently employed on a large scale, such as the butadiene types, the polyester/isocyanate material is mentioned for its potential future applications.

Synthetic Rubber Latices

Major butadiene/styrene latices have developed along the following lines: high solids (50 to 65%); medium solids (35 to 50%); low solids (35% and below).

TABLE 6. NON-RUBBER CONSTITUENTS IN SYNTHETIC RUBBER LATICES

Type Latex	X-619	X-667	X-710	X-711	X-749	GR-S 2004
Butadiene/styrene	70/30	83/17	70/30	100/0	70/30	100/0
Reaction temp. (°F.)	50	50	50	50	50	115-150
Conversion (%)	60	60	70	60	60	90
	% on Solids					
Potassium	1.641	0.537	1.569	0.537	0.503	0.198
Sodium	0.022	0.389	0.268	0.389	0.312	0.200
Organic acid	4.423	3.680	3.760	3.680	3.349	3.056
Daxad* organic	2.188	1.460	1.875	1.460	1.167	
Other organic	0.531	0.939	1.390	0.860	0.962	0.278
SO_4 ion	0.659	0.057	1.183	0.057		0.237
PO_4 ion	0.213	0.250		0.250	0.200	
Fe ion	0.037					
Total	9.714	7.312	10.045	7.233	6.493	3.969
Rubber hydrocarbon in Solids (%)	90.29	92.69	89.95	92.77	93.51	96.03

*Dewey & Almy Chemical Co., Cambridge, Mass.

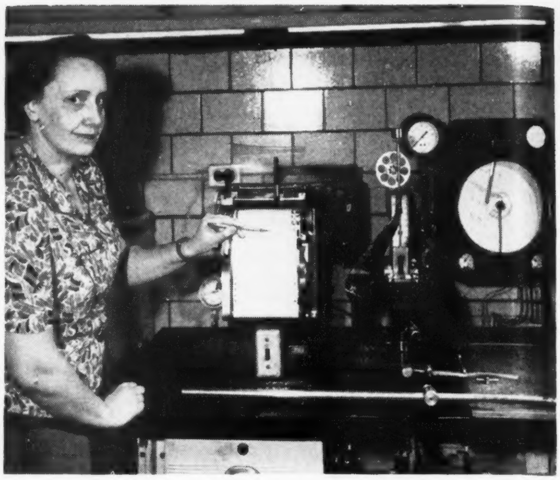


Fig. 7. The Olsen Flow Tester

High Solids Latices

High solids butadiene/styrene latices have been found most useful as blends with high solids natural rubber latices in making foamed latex rubber products. Synthetic rubber latices have been a major factor in foam rubber products. The difference in cost between the synthetic and natural rubber latices greatly influences the proportions used.

Table 6 presents some high solids latices used in producing latex foam rubber. The rubber hydrocarbon content of all the synthetic latices is lower than that of natural rubber latex concentrates. This disadvantage represents one of the serious disadvantages of the "cold" synthetic latices.

The stress/strain data of vulcanizates of these latices and their blends with natural rubber are depicted in Table 7.

Data on foam rubber incorporating various types of synthetic latices are given in Table 8.

From these data it can be seen that hot GR-S latex in foam rubber is superior in compression and aging as compared to an all-natural rubber foam. The GR-S latex, however, exhibits low stress/strain characteristics. Cold GR-S latex in foam rubber is superior in aging(13)

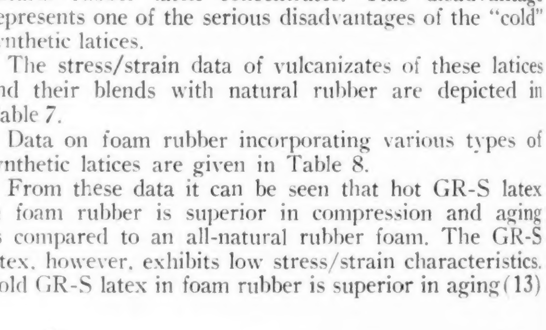


Fig. 8. U.S.A. Production (Thousands of Long Tons) of Neoprene and Nitrile Types of Synthetic Rubber in Thousands of Long Tons

TABLE 7. STRESS-STRAIN PROPERTIES OF LATEX VULCANIZATES*

Physical Tests R/Synthetic	Cure (Min. @ 220° F.)	X-710 T†	X-710 E‡	X-711 T	X-711 E	X-749 T	X-749 E	X-619 T	X-619 E	X-667 T	X-667 E	GR-S 2004 T	GR-S 2004 E
0/100	0	975	920	426	350	937	1150	625	520	735	840		
	5	694	500	357	340	542	560	579	450	500	520		
	10	652	430	400	360	531	560	500	450	438	390		
	20	635	390	348	320	506	570	550	450	393	300		
30/70	0	1400	780	1130	750	4130	625	2235	640	2250	910	421	320
	5	3390	610	1930	670	4210	570	2222	600	3240	730	447	230
	10	2710	590	1930	670	4110	600	2444	600	3610	660	430	220
	20	2440	580	1470	600	3466	670	2100	570	2670	620	780	250
50/50	0	2140	760	2160	830	2730	950	2460	820	3110	870	1460	530
	5	3280	610	3350	690	4880	740	3000	740	4450	770	2550	500
	10	3840	630	3610	640	5190	760	3750	740	4330	700	1890	490
	20	2930	620	3760	660	4930	750	3389	700	4520	710	1890	540
70/30	0					3940	890					3060	670
	5					5380	750					4020	570
	10					5600	770					4350	600
	20					5830(JB)*	770					3910	600
100/0	0	5440	900	Same				5440	900	5440	900	Same	
	5	5750	800	Same				5750	800	5750	800	Same	
	10	5820	750	Same				5820	750	5820	750	Same	
	20	5560	700	Same				5560	700	5560	700	Same	

*All were prepared from latex cast films.
†Tensile (psi.).
‡Elongation, %.
*Jaw break.

and, when used in place of hot GR-S in the natural/synthetic blends, it is greatly superior in stress/strain properties. The main advantage of the polybutadiene latices in the blends, as compared to the copolymers, is their improvement in the odor of the foam. Some have asserted that the presence of polybutadiene in the foam rubber even improves the odor of the foam, as compared to an all-natural rubber foam. The 100% natural rubber foam is greatly superior to the synthetics and the natural/synthetic blends in stress/strain properties.

The correlation between the stress/strain values of the film vulcanizates and the foam rubber consisting of the same polymer blend is not too good. As can be seen in Table 7, the tensile strength of X-749 film vulcanizate is 937 lbs./inch^2 maximum as compared to 5,820 lbs./inch^2 for the natural film vulcanizate. However, the tensile of the foam consisting of 100% X-749 polymer is 10.5 lbs./inch^2 as compared to 31.6 lbs./inch^2 for the 100% natural foam rubber (Table 8). Whereas there is a sixfold difference in the film strength, there is only a little more than a threefold difference in the foam rubber strength. Reasons for this great difference have been ascribed to various factors, among which are: (a) the true tensile evaluation of the film is clouded by the inferior tear resistance of the synthetic, but this does not show up in the foam evaluation because of its structure; (b) in film evaluation over-vulcanization occurs which is decreased in the foam because of its lower heat-transfer rate; (c) the optimum compounding formula has not been found for the synthetic.

It should be pointed out, however, that more than 50% of the U.S.A. foam production has been on a 50% natural/50% hot synthetic blend. As can be seen in Table 8 the tensile value of this type of foam is equivalent to that of the 100% synthetic X-710 and X-749. If these latter latices had been available during the last "high-price" period of natural rubber, it seems quite certain that an all-synthetic foam rubber would have been supplied by the American foam rubber industry. As it actually happened, the increase in price of natural rubber

TABLE 8. SYNTHETIC LATICES IN FOAM RUBBER

Type of Synthetic / Type of Polymerization	X-619 Cold	X-667 Cold	X-710 Cold	X-711 Cold	X-749 Cold	GR-S 2004 Hot	Natural
100% Synthetic							
Density, lbs./in.^{3}	0.00400	0.00400	0.00400	0.00400	0.00400	Foam	0.00400
RMA compression*, (lbs./50 sq. in.)	25.0	25.8	25.5	27.2	24.6	sample	28.0
Tensile strength, psi.	7.5	8.6	11.5	6.4	10.5	was too	31.6
Elongation, %	174	165	173	100	206	crumbly.	343
Weight penalty, %	−4.8	−3.7	−4.5	−1.25	−5.75		0.0
50% Natural/50% Synthetic							
Density, lbs./in.^{3}	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400
RMA compression*, (lbs./50 sq. in.)		26.5	24.8	26.4	26.2	31.8	
Tensile strength, psi.		21.0	19.5	16.5	20.7	10.4	
Elongation, %	Foam not	355	249	320	315	147	
Weight penalty,—, or weight gain, +, %	tested	−2	−5	−2.5	−2.75	+6.25	
Long-Term Aging							
Natural Rubber/Synthetic Ratio							
Hrs. at 212° F. to 20% increase in compression	100/0			570		570	570
	50/50			807		950	
	0/100			960			
% improvement as compared to 100% natural rubber foam	100/0						
	50/50			41.5		66.6	
	0/100			68.5			

*"The RMA Buyer's Specification for Latex Foam, April 1, 1953." Rubber Manufacturers Association, Inc., 444 Madison Ave., New York, N. Y.

resulted in a decrease, and in many cases a loss of business for the foam manufacturers. Foam rubber has healthy and aggressive competition from the spring and allied industries at all times, and when prices get out out of line, it is disastrous for the foam rubber producers.

The major problem faced by the foam rubber manufacturers in using cold synthetic latices is the weight-penalty incurred. Various theories have been advanced for this disadvantage, among which are: (a) the synthetic is slower curing; (b) the synthetic results in a more elliptical type of structure instead of the more uniform pore of the natural rubber foam; (c) the plasticity of the polymer is too low, and a lower modulus rubber results in a lower compression foam; and (d) the presence of very strong surface active ingredients that remain, even after gellation and vulcanization, results in a greater quantity of "unused" curing ingredients being washed out of the foam.

When the synthetic foam is not washed, it has greater compression. Also, when quantities of anionic surface active materials, such as Daxad, are added to natural rubber latex, the foam rubber made from it also shows a "weight penalty." The weight penalty problem is being investigated by the industry, and some improvement has been made.

Latex foam cushioning consists of slab stock and cored stock. The presence of the cores results in an economy in the over-all weight of the cushion. It is more economical to build a cushion containing cores with a foam slightly higher in density than it is to make a cushion without cores at a lower density, the compression of the cushion being the same in either case.

For the majority of cushioning purposes a foam density of .00400 lbs./cubic inch is used for slab stock. Foam of this density would provide a RMA compression of approximately 40 pounds. When a different elastomer is used to replace all or part of that commonly used, which is usually natural rubber latex, the density required to obtain a RMA compression of 40 pounds is determined. If the density of the new foam is required to be a .00450 lbs./cubic inch, then a weight penalty of

$$\frac{.00450 - .00400}{.00400} \times 100 = 12\tfrac{1}{2}\% \text{ exists.}$$

For a more accurate determination of this factor, not one but several values at various compressions are used. This procedure compensates for the variables that may be introduced in processing the foam. The values are plotted with the compression along the ordinate and the density along the abscissa. A graph is drawn for the control sample and another for the foam containing the new latex. Usually five points on each graph are obtained between .00250 lbs./cu. in. density and .00600 lbs./cu. in. At .00400 lbs./cu. in. density on the control graph, the compression is determined, and found to be about 40 pounds by the RMA test. The density required for this compression on the experimental foam chart is then taken and the weight penalty, or weight gain, may be calculated as described above.

Although large amounts of low-temperature polymerization cold synthetic rubber latices are presently being used, they have not yet replaced high-temperature polymerization (hot) synthetic rubber latices and natural rubber latex in the manufacture of foamed rubber. Earlier, this had been the expectation.

Medium Solids Latices

Medium per cent. solids latices (35 to 50) include a group whose particle size and related characteristics are such that they cannot be consistently concentrated and handled above 50% solids. Some medium solids latices can be made directly in the polymerization reactor without the necessity of concentration.

End-uses for these latices have been in paper and textile impregnation as well as in adhesives.

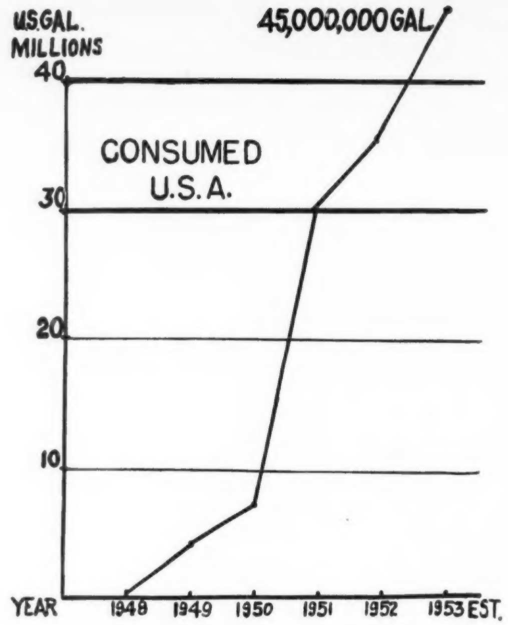


Fig. 9. U.S.A. Consumption of Latex Paints

Low Solids Latices

Low solids latices which are below 35% in solids can be made in most standard GR-S plants. If a large use develops, economic pressure may force these to a higher concentration of solids. Also, concentrating equipment is now available so that higher solids latex can be made without loss of quality.

As compared to the problem of concentrating natural rubber latex, which is usually accomplished by either centrifuging or creaming, the concentration of synthetic rubber latices is rather simple and inexpensive. The high stability characteristic of most of the synthetic latices makes heat concentration relatively easy. There is no waste such as takes place in the serum part of natural rubber latex. As the use of synthetic latices increases, a savings in freight may be obtained by concentrating all synthetic latices to their maximum solids content.

Paint Latices

Paint latex is a medium solids latex whose use has expanded enormously during the past few years. Figure 9 shows the increase in consumption of water-base paint latex in the U.S.A. Much of this material made to date has been a plasticized high styrene resin rather than a rubber.

Paint latex has been developed privately in the U.S.A. This flourishing business is completely outside the government synthetic rubber program.

Chemical Engineering

Ideas showing promise in the laboratory are subjected to chemical engineering experimentation on pilot-plant and production scales. Finally, the product graduates to

(Continued on page 238)

Vulcanization of the W Types of Neoprene Combinations of a Thiuram, a Guanidine, and Sulfur[1]

By **R. M. Murray**[2] *and* **D. C. Thompson**[2]

NEOPRENE Type W compounds, with both carbon black and clay loading, accelerated with a combination of a thiuram and a guanidine with sulfur and metallic oxides, combine a high degree of processing safety with an adequate cure rate. With red lead the combination provides compounds with a high degree of water resistance.

Reduction in sulfur increases heat resistance but with a loss in state of cure. The addition of 2-mercapto-imidazoline increase the cure rate without serious loss of processing safety.

THE trend toward higher mixing and processing temperatures in the rubber industry has increased the need of compositions which combine an adequate rate of vulcanization with sufficient processing safety. The work reported in this paper is the result of a study designed to develop compositions of the W types of neoprene in which these characteristics are more fully realized than those previously reported.

Neoprene Type W compositions require certain organic accelerators, in addition to metallic oxides, in order to develop high rates and states of vulcanization. Forman *et al.* (1)[3] have shown that many accelerators commonly used in other elastomers are effective in Neoprene Type W, particularly in the presence of sulfur. Other organic chemicals are effective in providing even higher rates and states of vulcanization when used in the absence of sulfur (2). Among these are p,p'-diamino diphenyl methane, the di-ortho-tolylguanidine salt of dicatechol borate, 2-mercapto-imidazoline, salicylic acid, and 2-mercapto-thiazoline. These effects apply as well to Neoprene Types WRT (3) and WHV (4). Fritz and Mayo (5) have shown that by varying the ratio and the concentration of metallic oxides in the presence of certain of these accelerators, the scorch characteristics and the cure rate of Neoprene Type W compositions can be controlled within certain limits.

By suitable adjustment in the vulcanization systems previously reported for the W types of neoprene, compositions have been developed with adequate scorch resistance for most processing conditions. However, a sufficient margin of processing safety for those stocks mixed at temperatures above 121° C. (250° F.) had been attained previously only by a substantial reduction in the rate and/or state of cure.

A compromise between scorch resistance and vulcanizate quality has been sought in previous investigations through the use of guanidine or thiuram acceleration of sulfur-containing compositions of the W types of neoprene. Recent work has shown that if the guanidine and the thiuram are used in combination, a major increase in processing safety results with no loss in rate of cure, and an improvement in many vulcanizate properties. The experiments reported in this paper show these effects and how they vary with the amount and type of thiuram and guanidine, sulfur concentration, type of metallic oxides, loading, type of neoprene, and vulcanization temperature.

All compositions discussed herein were prepared and tested in accordance with procedures established by the American Society for Testing Materials (6). The following designations are applicable to the various tests:

Tests	ASTM Designation
Stress, Tensile Strength, and Elongation	D412-51T
Compression Set	D395-52T (Method B)
Hardness	D676-49T
Resilience	D945-52T
Heat Aging	D865-52T

The processing safety of the compositions was measured by means of the Mooney shearing disk viscometer (ASTM D927-52T) operating at a temperature of 121° C. (250° F.) using the small rotor. The scorch values reported are the times in minutes for the Mooney viscosity to increase ten points from the minimum value. The relative storage stability of the uncured compositions also has been used as a measure of processing safety. It was determined by milling them at periodic intervals after storage at 50° C. (122° F.) on a six- by 12-inch laboratory mill with 50° C. water circulated through the rolls. The values reported are the number of days which elapsed before the compositions would no longer mill smoothly.

Effect of Thiuram and Guanidine

The first experiments were conducted for the purpose of establishing the combined effects of a thiuram and a guanidine in the presence of sulfur and metallic oxides on the processing safety, rate of vulcanization, and vulcan-

[1] Presented before the Division of Rubber Chemistry, A. C. S., Louisville, Ky., April 15, 1954. Contribution No. 100, E. I. du Pont de Nemours Co., Inc., Rubber Chemicals Division, Wilmington, Del.

[2] E. I. du Pont de Nemours & Co., Inc.

[3] Numbers in parentheses refer to Bibliography items at end of article.

[4] Throughout this investigation, technical products were used wherever possible, as follows: tetramethylthiuram monosulfide—Thionex; tetramethylthiuram disulfide—Thiuram M; dipentamethylenethiuram tetrasulfide—Tetrone A; di-ortho-tolylguanidine—DOTG; diphenylguanidine—DPG; 2-mercapto-imidazoline—NA-22; phenyl-beta-naphthylamine—Neozone D. (All du Pont Rubber Chemicals Division products.)

TABLE 1. EFFECT OF THIURAM AND GUANIDINE IN NEOPRENE TYPE W

Base Composition

Neoprene (as shown)	100
Phenyl-beta-naphthylamine	2
Magnesia	2
SRF carbon black	29
Zinc oxide	5

Composition	A-1	B-1	C-1	D-1	E-1	F-1
Neoprene Type	W	W	W	W	WRT	W
Sulfur	1.0	1.0	1.0	1.0	1.0	—
Tetramethylthiuram monosulfide	1.0	—	0.5	1.0	1.0	—
Di-ortho-tolylguanidine	—	1.0	0.5	1.0	1.0	—
2-Mercapto-imidazoline	—	—	—	—	—	0.35
Mooney scorch at 121° C. (250° F.), minutes	14	21	42	42	44	10
Storage stability at 50° C. (122° F.), days	7	16	16	16	21	9
	Stress at 300% Elongation, Lb./Sq. Inch					
Minutes Cure at 153° C. (307° F.)						
10	925	700	975	925	675	1325
20	1000	1100	1275	1125	1150	1350
40	1200	1500	1425	1275	1350	1500
	Tensile Strength, Lb./Sq. Inch					
10	3700	3000	3500	3675	3175	3850
20	3550	3425	3625	3825	3500	3850
40	3550	3450	3725	3900	3225	3775
	Elongation at Break, %					
10	770	760	710	790	920	650
20	740	680	610	750	740	610
40	680	580	600	660	600	560
	Hardness, Durometer					
10	50	52	50	50	48	55
20	52	54	53	54	54	55
40	53	55	54	55	55	55
	Compression Set, %					
Cure 25'/153° C. (307° F.)						
22 Hours/70° C.	21	19	16	18	15	11
70 Hours/100° C.	72	71	65	70	79	37
	Heat Aging 7 Days/121° C. (250° m.)					
Cure 20'/153° C. (307° F.)						
Tensile strength, lb./sq. inch	2450	2250	2000	2475	2475	2575
Elongation, %	110	100	100	160	170	230
Hardness, durometer	80	82	80	76	75	74

izate properties of Neoprene Types W and WRT compositions. Tetramethylthiuram monosulfide[4] and di-ortho-tolylguanidine[4] were used, and compositions containing 0.5-part and 1.0 part each of these accelerators were compared with ones containing 1.0 part each of either accelerator in the absence of the other. Formulae and test data are shown in Table 1.

The outstanding resistance to Mooney scorch observed for the Neoprene Type W compositions containing the combinations of thiuram and guanidine was entirely unexpected. The authenticity of these values has been confirmed, however, by many repetitions of these experiments. The stability at 50° C. of the compositions containing both accelerators was greater than the composition containing the thiuram without the guanidine and equal to that containing the guanidine without the thiuram. The Neoprene Type W vulcanizates containing the combination of accelerators in either amount (C-1 and D-1), when cured 20 minutes at 153° C. (307° F.), had higher modulus, higher tensile strength, and greater resistance to compression set than those containing only one accelerator (A-1 and B-1). Whereas 0.5-part each of the thiuram and the guanidine were sufficient to vulcanize this Neoprene Type W composition, some advantage was gained in heat resistance by increasing the amount to 1.0 part of each accelerator. The data also show the same general effects with Neoprene Type WRT although, as has been observed previously with other accelerators (3), the rate of cure of Neoprene Type WRT is slightly slower than that of Neoprene Type W. A non-sulfur composition accelerated with the commonly employed 2-mercapto-imidazoline is shown for comparative purposes. It had a high rate and state of vulcanization, but obtained at such a sacrifice in processing safety as to be impracticable for many applications.

Effect in Clay-Loaded Compositions

The effectiveness of a neoprene accelerator is known to be influenced by the type of filler employed (7). The retarding effect of clay is a typical example. The accelerating effect of thiuram and guanidine therefore was studied in compositions containing 50 volumes of hard clay per 100 volumes of Neoprene Type W.

The results in Table 2 again show that the Mooney scorch resistance was increased by using the combination of tetramethylthiuram monosulfide and di-ortho-tolylguanidine over that obtained when either accelerator was employed independently. Storage stability was greater than that obtained with tetramethylthiuram monosulfide as the sole accelerator, but somewhat less than that with di-ortho-tolylguanidine.

The stock accelerated with tetramethylthiuram monosulfide only attained a higher state of cure than that containing di-ortho-tolylguanidine, which is the reverse of the effects obtained with carbon black loading (Table 1). The accelerating effect of a combination of tetra-

TABLE 2. EFFECT OF THIURAM AND GUANIDINE IN CLAY-LOADED NEOPRENE TYPE W

Base Composition

Neoprene Type W	100
Phenyl-beta-naphthylamine	[illegible]
Stearic acid	0
Petrolatum	2.
Magnesia	2.
Hard clay	105.
Circo oil	10.0
Sulfur	1.0
Zinc oxide	5.0

Composition	A-2	B-2	C-2
Di-ortho-tolylguanidine	1.0	—	1.0
Tetramethylthiuram monosulfide	—	1.0	1.0
Mooney scorch at 121° C. (250° F.), minutes	22	20	35
Storage stability at 50° C. (122° F.), days	19	7	10
	Stress at 400% Elongation, Lb./Sq. Inch		
Minutes Cure at 153° C. (307° F.)			
10	600	950	800
20	825	950	875
40	900	900	875
	Tensile Strength, Lb./Sq. Inch		
10	1350	2350	2050
20	2025	2500	2375
40	2475	2550	2175
	Elongation at Break, %		
10	840	860	870
20	860	860	840
40	850	850	760
	Hardness, Durometer		
10	48	56	56
20	53	57	60
40	60	59	61

TABLE 3. EFFECT OF TYPE OF THIURAM AND GUANIDINE IN CARBON BLACK-LOADED NEOPRENE TYPE WRT

Base Composition

Neoprene Type WRT	100
Phenyl-beta-naphthylamine	2
Magnesia	2
SRF carbon black	29
Zinc oxide	5
Sulfur	1

Composition	A-3	B-3	C-3	D-3
Diphenylguanidine	1.0	—	—	—
Di-ortho-tolylguanidine	—	1.0	1.0	1.0
Tetramethylthiuram monosulfide	1.0	1.0	—	—
Disulfide	—	—	1.0	—
Dipentamethylene thiuram tetrasulfide	—	—	—	1.0
Mooney scorch at 121° C. (250° F.), minutes	43	44	35	38
Storage stability at 50° C. (122° F.), days	20	22	21	22
	Stress at 200% Elongation, Lb./Sq. Inch			
Minutes Cure at 153° C. (307° F.)				
10	325	325	375	375
20	475	550	575	625
40	600	650	650	700
	Stress at 300% Elongation, Lb./Sq. Inch			
10	675	675	800	825
20	1000	1150	1200	1325
40	1275	1350	1425	1650
	Tensile Strength, Lb./Sq. Inch			
10	3025	3175	3250	3150
20	3475	3500	3425	3325
40	3300	3225	3350	3100
	Elongation at Break, %			
10	940	920	880	870
20	790	740	700	610
40	620	600	600	610
	Hardness, Durometer			
10	48	49	50	49
20	54	53	53	55
40	56	56	55	59
Cure 25'/153° C. (307° F.)	Compression Set, %			
22 Hours/70° C. (158° F.)	15	15	12	12
70 Hours/100° C. (212° F.)	76	79	70	68
Cure 20'/153° C. (307° F.)	Heat Aging 7 Days at 121° C. (250° F.)			
Tensile strength, lb./sq. inch	2650	2775	2625	2750
Elongation, %	250	240	200	140
Hardness, durometer	74	75	76	79

methylthiuram monosulfide and di-ortho-tolylguanidine in clay-loaded Neoprene Type W likewise differed from the effect observed with carbon black loading in that the combination was no stronger in accelerating effect than that obtained with tetramethylthiuram monosulfide in the absence of di-ortho-tolylguanidine.

Effect of Different Thiurams and Guanidines

The next experiments established the effect of changing the specific guanidine and thiuram used in combination in a Neoprene Type WRT composition. Di-ortho-tolylguanidine and diphenylguanidine were compared in the presence of tetramethylthiuram monosulfide in compositions containing 20 volumes of SRF carbon black. Tetramethylthiuram monosulfide, tetramethylthiuram disulfide, and dipentamethylenethiuram tetrasulfide were compared in the presence of di-ortho-tolylguanidine. The compositions and physical tests results are shown in Table 3.

In the presence of tetramethylthiuram monosulfide, similar effects were noted with diphenylguanidine and di-ortho-tolylguanidine (C-3 and D-3). Differences were noted when the type of thiuram was varied in the presence of di-ortho-tolylguanidine. Tetramethylthiuram monosulfide gave the greatest scorch resistance (B-3); however, the compositions had equal storage stability. Changing to a thiuram of higher sulfur concentration, as in progressing from the mono- to di- and tetra-sulfides, resulted in lower tensile strength, higher modulus and hardness, lower compression set, and less heat resistance.

Diphenylguanidine next was compared with di-ortho-tolylguanidine at both the 0.5- and 1.0-part level in the presence of 1.0 part of tetramethylthiuram monosulfide in a clay-loaded Neoprene Type W composition. The data in Table 4 show somewhat different effects than were noted with carbon black-loaded Neoprene Type WRT compositions. Di-ortho-tolylguanidine produced a slightly higher state of cure than diphenylguanidine as measured by stress-strain and compression set resistance. Diphenylguanidine provided greater resistance to Mooney scorch and bin stability than di-ortho-tolylguanidine. These effects were found for both ratios of guanidine to tetramethylthiuram monosulfide.

Effect of Varying Thiuram-Guanidine Ratio

The results so far presented pertain to compositions containing equal amounts by weight of thiuram and

TABLE 4. EFFECT OF TYPE OF GUANIDINE IN CLAY-LOADED NEOPRENE TYPE W

Base Composition

Neoprene Type W	100
Phenyl-beta-naphthylamine	2
Stearic acid	0.5
Petrolatum	2.0
Magnesia	2.0
Hard clay	105.3
Circo oil	10.0
Sulfur	1.0
Tetramethylthiuram monosulfide	1.0
Zinc oxide	5.0

Composition	A-4	B-4	C-4	D-4
Di-ortho-tolylguanidine	0.5	—	1.0	—
Diphenylguanidine	—	0.5	—	1.0
Mooney scorch at 121° C. (250° F.), minutes	34	39	35	43
Storage stability at 50° C. (122° F.), days	9	10	10	15
	Stress at 400% Elongation, Lb./Sq. Inch			
Minutes Cure at 153° C. (307° F.)				
10	750	775	800	725
20	925	825	875	825
40	950	850	875	850
	Tensile Strength, Lb./Sq. Inch			
10	1900	1925	2050	2025
20	2475	2250	2375	2125
40	2425	2225	2175	2125
	Elongation at Break, Lb./Sq. Inch			
10	840	790	870	870
20	870	830	840	860
40	800	770	760	760
	Hardness, Durometer			
10	50	55	56	54
20	59	60	60	60
40	62	62	61	63
Cure 25'/153° C. (307° F.)	Compression Set, %			
22 Hours/70° C. (158° F.)	45	48	40	47
70 Hours/100° C. (212° F.)	91	92	89	92
Cure 20'/153° C. (307° F.)	Heat Aging 7 Days at 121° C. (250° F.)			
Tensile strength, lb./sq. inch	1825	1750	1600	1600
Elongation, %	150	120	200	220
Hardness, durometer	85	85	84	84

guanidine. It was assumed that the effect of varying the ratio of one to the other would be more pronounced in slower curing compositions. Therefore Neoprene Type WRT and clay-loaded Neoprene Type W compositions were chosen for this study.

The data in Table 5 show that in clay-loaded Neoprene Type W compositions, Mooney scorch rate and original vulcanizate properties were not affected significantly by varying the thiuram-guanidine ratio within the limits of 0.5/1.0 to 1.0/0.5. When the ratio of thiuram to guanidine was increased, storage stability was reduced (B-5).

Resistance to aging at 121° C. (250° F.) measured by elongation retention was superior for the composition containing 1.0 part of each accelerator (A-5). This condition is attributed to the increased amount of accelerator rather than to the change in ratio.

With the carbon black-loaded Neoprene Type WRT compositions it also was found that the effect of changing the accelerator ratio was not critical. The data in Table 6 show that only when the total amount of accelerator was increased, was there a significant change in properties (D-6). By increasing the thiuram and the guanidine from 0.75-part each to 1.0 part each, higher modulus was obtained.

TABLE 5. EFFECT OF VARYING THIURAM AND GUANIDINE RATIOS IN CLAY-LOADED NEOPRENE TYPE W

Base Composition

Neoprene Type W	100
Phenyl-beta-naphthylamine	2
Stearic acid	0.5
Petrolatum	2.0
Magnesia	2.0
Hard clay	105.3
Circo oil	10.0
Sulfur	1.0
Zinc oxide	5.0

Composition	A-5	B-5	C-5
Di-ortho-tolylguanidine	1.0	0.5	1.0
Tetramethylthiuram monosulfide	1.0	1.0	0.5
Mooney scorch at 121° C. (250° F.), minutes	35	34	36
Storage stability at 50° C. (122° F.), days	10	9	13
	Stress at 400% Elongation, Lb./Sq. Inch		
Minutes Cure at 153° C. (307° F.)			
10	800	750	875
20	875	925	850
40	875	950	925
	Tensile Strength, Lb./Sq. Inch		
10	2050	1900	2150
20	2375	2475	2175
40	2175	2425	2450
	Elongation at Break, %		
10	870	840	850
20	840	870	850
40	760	800	820
	Hardness, Durometer		
10	56	50	55
20	60	59	59
40	61	62	61
Cure 25'/153° C. (307° F.)	Compression Set, %		
22 Hours/70° C. (158° F.)	40	45	45
70 Hours/100° C. (212° F.)	89	91	90
Cure 20'/153° C. (307° F.)	Heat Aging 7 Days at 121° C. (250° F.)		
Tensile strength, lb./sq. inch	1600	1825	1750
Elongation, %	200	150	130
Hardness, durometer	84	85	86

TABLE 6. EFFECT OF VARYING THIURAM AND GUANIDINE RATIO

Base Composition

Neoprene Type WRT	100
Phenyl-beta-naphthylamine	2
Magnesia	2
SRF carbon black	29
Zinc oxide	5
Sulfur	1

Composition	A-6	B-6	C-6	D-6
Di-ortho-tolylguanidine	0.5	1.0	0.75	1.0
Tetramethylthiuram monosulfide	1.0	0.5	0.75	1.0
Mooney scorch at 121° C. (250° F.), minutes	45+	43	43	44
Storage stability at 50° C. (122° F.), days	20	22	20	22
	Stress at 200% Elongation, Lb./Sq. Inch			
Minutes Cure at 153° C. (307° F.)				
10	275	250	250	325
20	375	425	425	550
40	475	500	550	650
	Stress at 300% Elongation, Lb./Sq. Inch			
10	600	500	550	675
20	875	925	875	1150
40	1150	1150	1150	1350
	Tensile Strength, Lb./Sq. Inch			
10	2750	2875	3150	3175
20	3325	3700	3500	3500
40	3075	3550	3475	3225
	Elongation at Break, %			
10	980	900	910	920
20	820	740	800	740
40	630	650	680	600
	Hardness, Durometer			
10	49	45	48	49
20	52	52	52	53
40	54	55	55	56
Cure 25'/153° C. (307° F.)	Compression Set, %			
22 Hours/70° C. (158° F.)	17	15	15	15
70 Hours/100° C. (212° F.)	78	71	75	79
Cure 20'/153° C. (307° F.)	Heat Aging 7 Days at 121° C. (250° F.)			
Tensile strength, lb./sq. inch	2575			2775
Elongation, %	210			240
Hardness, durometer	74			75

Accelerator Effect with Different Metallic Oxides

The majority of neoprene compounds contain magnesium and zinc oxides as vulcanizing agents. In some cases, particularly where a high degree of resistance to swelling in water is required, it is advantageous to replace these oxides with one of the oxides of lead. All previous tests have indicated that with Neoprene Type W compositions, regardless of whether litharge or red lead was used, acceleration to produce a satisfactory cure rate has always been accompanied by excessive scorching tendencies (9). The effect of using the combination of 1.0 part of tetramethylthiuram monosulfide and 1.0 part of di-ortho-tolylguanidine is shown in the data in Table 7. Stocks containing 20.0 parts of litharge (PbO), 20.0 parts of red lead (Pb_3O_4), and a combination of 4.0 parts of magnesium oxide (MgO) and 5.0 parts of zinc oxide (ZnO) were compared.

Processing safety, as measured by Mooney scorch, was improved greatly by substitution of red lead for litharge although, as is generally found, the magnesium oxide-zinc oxide composition was safest. Very slight differences were noted in the stress-strain characteristics of the three compositions. The litharge-containing composition had the fastest rate of cure. The compression set

TABLE 7. EFFECT OF TYPE OF METALLIC OXIDE WITH THIURAM AND GUANIDINE

Base Composition	
Neoprene Type W	100
Phenyl-beta-aphthylamine	2
MPC carbon black	20
MT carbon black	70
Light process oil	15
Stearic acid	0.75
Di-ortho-tolylguanidine	1.0
Tetramethylthiuram monosulfide	1.0
Sulfur	1.0

Composition	A-7	B-7	C-7
Litharge	20	—	—
Red lead	—	20	—
Magnesia	—	—	4
Zinc oxide	—	—	5
Mooney scorch at 121° C. (250° F.), minutes	8	26	36
Storage stability at 50° C. (122° F.), days	17	17	17
	Stress at 200% Elongation, Lb./Sq. Inch		
Minutes Cure at 153° C. (307° F.)			
10	750	575	575
20	1025	925	925
40	1150	1250	1025
	Tensile Strength, Lb./Sq. Inch		
10	2075	1975	1825
20	2375	2375	2125
40	2450	2325	2075
	Elongation at Break, %		
10	460	520	440
20	400	440	380
40	380	340	340
	Hardness, Durometer		
10	54	55	50
20	59	57	55
40	60	60	60
Cure 25'/153° C. (307° F.)	**Compression Set, %**		
22 Hours/70° C. (158° F.)	38	39	18
70 Hours/100° C. (212° F.)	75	77	75
Cure 20'/153° C. (307° F.)	**Volume Increase in 70° C. Water, %**		
28 Days	5	5	30

resistance at 70° C. of the composition containing magnesium oxide and zinc oxide was the greatest.

The superior water resistance of neoprene compositions vulcanized with oxides of lead in the absence of magnesium oxide is well known (8). This effect is noted in the low water swelling values reported for Compositions A-7 and B-7. Previously reported water-resistant neoprene compositions were limited in applicability owing to their tendency to scorch under many processing conditions. The processing safety of the water-resistant composition, B-7, containing red lead and accelerated with a combination of a thiuram and a guanidine is great enough to suggest its practicability in most applications.

Effect of Sulfur Concentrations

The addition of sulfur to a neoprene composition is known to affect adversely the resistance to heat aging as well as certain other properties. A series of preliminary tests indicate that with the accelerator combinations being studied in this investigation at least 1.0 part of sulfur was required in stocks containing non-black fillers or heavily loaded with adsorptive types of carbon black. These same tests, however, indicated that in a stock similar to the test recipe used in the majority of the work it should be possible to use a lower concentration of sulfur. A study was therefore made to determine the effect of reducing the sulfur concentration from the 1.0-part level so far used.

The data in Table 8 show these effects in a carbon black-loaded Neoprene Type W composition accelerated with 0.5-part each of a thiuram and a guanidine. Decreasing the sulfur reduced the state of cure slightly as measured by stress-strain and increased resistance to compression set and heat aging. Composition D-8 had a lower state of cure as judged by hand test than is indicated by the test data. Little effect on Mooney scorch or storage stability was noted except that, with the stock containing no elemental sulfur (D-8), these values were greater. Specimens vulcanized 20 minutes at 153° C. (307° F.) were analyzed for uncombined sulfur in accordance with the procedure outlined in ASTM D297-50T. The values were found to be proportional to the total amount of elemental sulfur mixed into the stocks.

Non-black, precipitated calcium carbonate-loaded Neoprene Type W compositions having varying concentrations of sulfur also were studied [not shown]. It was found that decreasing the sulfur concentration in stocks containing tetramethylthiuram monosulfide and di-ortho-tolylguanidine had a much more pronounced effect on modulus and cure rate than observed for carbon black-loaded compositions. Full cure was not obtained in 20 minutes at 153° C. (307° F.) when the sulfur was omitted.

TABLE 8. EFFECT OF SULFUR CONCENTRATION

Base Composition	
Neoprene Type W	100
Phenyl-beta-naphthylamine	2
Magnesia	2
SRF carbon black	29
Zinc oxide	5
Di-ortho-tolylguanidine	0.5
Tetramethylthiuram monosulfide	0.5

Composition	A-8	B-8	C-8	D-8
Sulfur	1.0	0.5	0.25	—
Mooney scorch at 121° C. (250° F.), minutes	45	45	45	45+
Storage stability at 50° C. (122° F.), days	15	15	15	17
	Stress at 200% Elongation, Lb./Sq. Inch			
Minutes Cure at 153° C. (307° F.)				
10	425	375	350	325
20	525	500	475	400
	Stress at 300% Elongation, Lb./Sq. Inch			
10	850	725	725	700
20	1075	1050	1000	925
	Tensile Strength, Lb./Sq. Inch			
10	3250	3325	3300	3300
20	3450	3350	3625	3425
	Elongation at Break, %			
10	840	870	850	900
20	780	700	750	820
	Hardness, Durometer			
10	51	50	50	45
20	53	52	52	50
	% Uncombined Sulfur			
20	0.46	0.22	0.10	Nil
Cure 25'/153° C. (307° F.)	**Compression Set, %**			
22 Hours/70° C. (158° F.)	15	13	12	12
70 Hours/100° C. (212° F.)	74	69	56	36
Cure 20'/153° C. (307° F.)	**Heat Aging 7 Days at 121° C. (250° F.)**			
Tensile strength, lb./sq. inch	2250	2125	2075	2100
Elongation, %	80	120	150	190
Hardness, durometer	86	84	79	76

TABLE 9. EFFECT OF 2-MERCAPTO-IMIDAZOLINE

Composition	A-9	B-9	C-9	D-9	E-9
Sulfur	1	1	1	1	—
Di-ortho-tolylguanidine	0.5	0.5	0.5	0.5	—
Tetramethylthiuram monosulfide	0.5	0.5	0.5	0.5	—
2-Mercapto-imidazoline	—	0.2	0.4	0.6	0.4
Mooney scorch at 121° C. (250° F.), minutes	30	21	19	17	10
Cure 10 Minutes at 153° C. (307° F.)					
Stress at 200% elongation, lb./sq. inch	825	975	1125	1200	1125
Tensile strength, lb./sq. inch	2050	2300	2625	2625	2150
Elongation at break, %	540	580	560	520	520
Hardness, durometer	65	65	65	67	65

Base Composition

Neoprene Type W	100
Phenyl-beta-naphthylamine	2
Heliozone	3
Magnesia	4
SRF carbon black	20
MAF carbon black	20
Hard clay	50
Light process oil	12
Zinc oxide	5

Effect of 2-Mercapto-Imidazoline

In certain applications faster rates of cure are needed than shown for the thiuram and guanidine accelerated compositions so far presented. It was particularly desirable to increase the modulus of vulcanizates cured 10 minutes at 153° C. (307° F.). The next experiments were performed to determine if this increase could be accomplished without a major loss in processing safety by adding incremental amounts of 2-mercapto-imidazoline. A commercial type, carbon black and clay-loaded Neoprene Type W composition containing 0.5-part each of thiuram and guanidine was used in this study. Table 9 shows that, as 2-mercapto-imidazoline was added in 0.2-part increments, the modulus of the vulcanizates cured for 10 minutes at 153° C. (307° F.) increased progressively, accompanied, however, with a decrease in Mooney scorch resistance. A composition containing 0.4-part of 2-mercapto-imidazoline in addition to thiuram, guanidine, and sulfur (C-9) developed the same modulus as the control (E-9) accelerated with 0.4-part of 2-mercapto-imidazoline only, yet had nearly double the Mooney scorch resistance.

Effect of Vulcanization Temperature

Compound D-1, shown in Table 1, was cured in open steam at 225 psi. (200° C.—392° F.) for periods of time from 20 seconds to 120 seconds. The stress values of the resultant vulcanizates are plotted *versus* time of cure in Figure 1. Stress values are plotted in a similar manner for vulcanizates which were press cured at 153° C. (307° F.) The data indicate that vulcanizates cured in open steam for 60 seconds at 203° C. (397° F.) have a state of cure equivalent to that obtained by press curing for 20 minutes at 153° C. (307° F.).

Other compositions of the W types of neoprene accelerated with tetramethylthiuram monosulfide and di-ortho-tolylguanidine have been vulcanized in air after 24 hours under conditions of 93° C. (200° F.) temperature and atmospheric pressure.

Effect of Processing at High Temperature

The practical application of this work may be estimated from the results obtained by mixing certain com-

Composition

Neoprene Type W	100
Phenyl-beta-naphthylamine	2
Magnesia	2
SRF carbon black	29
Zinc oxide	5
Di-ortho-tolylguanidine	1
Tetramethylthiuram monosulfide	1
Sulfur	1

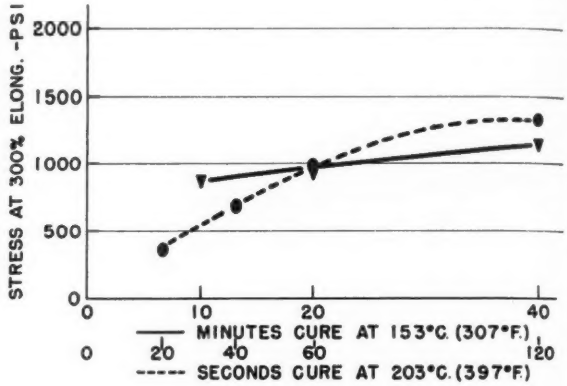


Fig. 1. Stress at 300% Elongation *versus* Time of Cure. Dotted Line Is Open Steam Cure. Solid Line Is Press Cure

mercial-type compositions at high temperature in an internal mixer. Neoprene Type W compositions loaded with MT carbon black, HAF carbon black, and hard clay; and a Neoprene Type WHV composition containing large quantities of MT carbon black and oil are shown in Table 10. These were mixed in an internal mixer of 4,300 ml. capacity with a speed of 70 rpm. on one rotor and 64 rpm. on the other. No cooling water was circulated through either the shell or the rotors. While the mode of adding the ingredients varied with each composition, all stocks were mixed in one stage requiring from six to eight minutes. Accelerator, sulfur, and zinc oxide were added one minute before discharge. The stock temperatures were measured with a needle pyrometer at discharge. The lowest temperature, 115° C. (240° F.), was recorded for the highly extended Neoprene Type WHV composition. The HAF carbon black-loaded stock reached the highest temperature, 157° C. (315° F.). All of the compositions were sheeted off a 30-inch mill, with no evidence of scorch.

The effect of mixing temperature on the scorch rate of Compositions B-10 and C-10 also is shown in Table 10. The Mooney scorch values of these batches mixed on a cool six- by 12-inch mill are compared with those mixed as described above.

A Neoprene Type GN composition, having the same loading as Compound B-10 and no organic accelerator, had a Mooney scorch value of 41 minutes when mixed on a cool mill but scorched when mixed at the abnormally high temperature used in the internal mixer. These results show that Mooney scorch values determined for batches mixed on cool laboratory mills do not necessarily serve as an indication of processing safety under conditions of high-temperature mixing. The apparent discrepancy may be attributed, in this case, to the fact that with the Neoprene Type W compositions, high temperature had little effect until the accelerators and zinc oxide were added one minute before discharging. With the basically faster curing Neoprene Type GN, heat history during the early stages of mixing had a pronounced effect even though the zinc oxide was withheld until

TABLE 10. COMMERCIAL NEOPRENE TYPE W AND WHV COMPOSITIONS

Composition	A-10	B-10	C-10	D-10
Neoprene Type W	100	100	100	—
WHV	—	—	—	100
Phenyl-beta-naphthylamine	2	2	2	2
Magnesia	4	4	2	4
Paraffin	—	—	—	2
Petrolatum	—	—	2	1
Stearic acid	1.0	0.5	0.5	0.5
MT carbon black	125	—	—	200
HAF carbon black	—	50	—	—
Hard clay	—	—	105.3	—
Light process oil	12	10	10	—
Extract of petroleum distillate	—	—	—	50.0
Zinc oxide	5.0	5.0	5.0	5.0
Di-ortho-tolylguanidine	0.5	1.0	0.75	0.75
Tetramethylthiuram monosulfide	0.5	1.0	0.75	0.75
Sulfur	1.0	1.0	1.0	1.0

Composition	Banbury Discharge Temperature °C.	Banbury Discharge Temperature °F.	Banbury-Mixed Mooney Scorch Time, Minutes	Mill-Mixed Mooney Scorch Time, Minutes	Banbury-Mixed Storage Stability @ 50° C., Days	Cured 20'/153° C. (307° F.) Stress @ 200% Elongation, Psi.	Tensile Strength, Psi.	Elongation, %	Durometer Hardness	Compression Set 22 Hrs. @ 70° C.	Compression Set 70 Hrs. @ 100° C.
A-10	135	275	45		19	1325	2100	400	64	9	59
B-10	157	315	15	39	6	1875	3450	330	66		
C-10	135	275	27	35	13	600	2425	800	59	39	90
D-10	115	240	45+		14	750	1575	400	51	23	57

the last minute before discharge. As a result, Composition B-10, after high temperature mixing, retained 15 minutes of its scorch value of 39 minutes as determined on a mill-mixed batch, but the Neoprene Type GN composition lost all of its 41 minutes of scorch time displayed at the lower mixing temperature.

All the compositions in Table 10 not only were free from a scorch when discharged from the internal mixer, but could be processed after a period of at least 15 days' storage at room temperature. Smooth tubing, 1¼-inch in diameter, with a ⅛-inch wall, was extruded with no special precautions at this time. It, therefore, is concluded that compositions of the W types of neoprene accelerated with a thiuram and a guanidine will prove of value when high-temperature mixing and processing conditions are indicated.

The physical properties of vulcanizates of these compositions cured 20 minutes at 153° C. (307° F.) are shown. For most applications these values represent a practical rate and state of cure.

Summary and Conclusions

The use of a combination of a thiuram and a guanidine with sulfur and metallic oxides in neoprene compositions of the W type produces stocks which combine a high degree of processing safety with a satisfactory rate of vulcanization. This is true with both carbon black and clay loading, and it is not influenced critically by the type, amount, or ratio of thiuram and guanidine used. Although particularly effective with magnesia and zinc oxide, the combination is also effective in producing safe processing, highly water-resistant neoprene compositions based on the use of red lead as the metallic oxide. Reduction in the sulfur concentration increases heat resistance, but with a loss in state of cure. The addition of 2-mercapto-imidazoline increases the cure rate without a serious loss in processing safety. Combinations of a thiuram and a guanidine affect vulcanization over a wide range of temperature. The curing systems described are free from scorch when processed at temperatures as high as 157° C. (315° F.).

Bibliography

(1) Report 49-3, 9 (1949). D. B. Forman, R. R. Radcliff, L. R. Mayo, du Pont Rubber Chemicals Division.

(2) D. B. Forman, R. R. Radcliff, L. R. Mayo, *Ind. Eng. Chem.*, 42, 686 (1950).

A. M. Neal, *Rubber Age (N. Y.)*, 67, 569 (1950).

Report 50-1, 5 (1950). R. R. Radcliff, L. R. Mayo, F. H. Fritz, du Pont Rubber Chemicals Division.

(3) Report 52-1, 1 (1952). D. B. Forman, R. R. Radcliff, du Pont Rubber Chemicals Division.

(4) BL Report 249 (1953). Du Pont Rubber Chemicals Division.

D. C. Thompson, *Rubber Age (N. Y.)*, 72, 638 (1953).

(5) *Ind. Eng. Chem.*, 44, 831 (1952).

(6) "ASTM Standards on Rubber Products, December 1952." American Society for Testing Materials, 1916 Race St., Philadelphia, Pa.

(7) "The Neoprenes," p. 66, N. L. Catton. E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. (1953).

(8) C. E. McCormack, R. H. Baker, R. S. Raff, *Rubber Age (N. Y.)*, 74, 72 (1953).

H. W. Starkweather, H. W. Walker, *Ind. Eng. Chem.*, 29, 872 and 1380 (1937).

(9) N. L. Catton, *Opus cit.*, p. 46.

Dow PVC Resins—100-4, -5, 111-1, -4

Improved formulations of polyvinyl chloride resins have been introduced by Dow Chemical Co., Midland, Mich. Designated Dow PVC 100-4, 100-5, 111-1, and 111-4, they are recommended for a wide variety of calendering, extrusion, and precompounded molding operations. The PVC 100-type polymers are of moderately high molecular weight; while the PVC 111 type are of medium molecular weight. Both types are credited with excellent heat stability.

Fabrication properties of the materials are reported as follows:

	PVC 100-4	PVC 100-5	PVC 111-1	PVC 111-4
Avg. absolute viscocity, cps.	2.35-2-50	2.35-2.50	1.90-2.05	1.90-2.05
Screen analysis, max., % on 50 mesh (U. S. Standard Sieve)	0.5	0.5	0.5	0.5
Plasticizer absorption, P.H.R.	28-30	28-30	28-30	28-30
Rigidity factor, P.H.R.	41-42	41-42	37-38	37-38
Milling temperature, ° F.	290-340	290-340	280-320	280-320
Banbury temperature, ° F.	280-350	280-350	275-310	275-310
Extrusion temperature, ° F.	300-370	300-370	300-360	300-360

A technical bulletin, "PVC Resins—Dow Polyvinyl Chloride," is available from the plastics technical service department of the company.

A Simple Objective Method for

CRACKING of rubber, subject to strain, both natural and synthetic, by atmospheric ozone has become a major problem in the increasing usage of rubber in services for which its physical properties so admirably suit it. The cracks which may vary widely in size make the article unsightly and finally unserviceable. Rubber goods have been found to suffer from rapid deterioration in urban areas where recent studies have shown high ozone concentrations.

The desirability of determining the atmospheric ozone concentration under various conditions has been pointed out by Reynolds,[2] Von Rossem and Talen,[3] Crabtree and Erickson,[4] and Bradley and Haagen-Smit.[5] They suggest the use of a standard rubber compound as a means of accomplishing this objective on the presumption that the cracking of rubber subject to strain is a specific test for the presence of ozone.

The Crabtree and Erickson procedure involves stretching a specimen of the standard compound (which is cured in a polished mold and has the glossy surface preserved by applying a sheet of cellophane over it until ready for use), exposing to the atmosphere to be tested, and observing with a magnifying glass (7-8 power) at five-minute intervals for the appearance of minute pin-point eruptions. The first appearance of these eruptions constitute the end-point of the test.

The Bradley and Haagen-Smit method consists in exposing a doubled $\frac{1}{16}$-inch strip, also cured in a polished mold, to a stream of air to be tested at some constant rate of flow. The end-point is the moment when cracking is first observed under a magnifying glass (four power).

Both methods depend to a considerable degree on the judgment and visual acuity of the observer. In this laboratory attempts were made to evaluate the Crabtree and Erickson procedure by comparing the ability of different observers to discern the presence or absence of the pin-point eruptions. The lack of agreement was so serious as to cast considerable doubt on the value of the procedure for general use.

Various schemes were considered in an attempt to utilize rubber as the "reagent" in a manner which would be objective and would not depend on the judgment of the observer. In addition, it was desired that the test be as simple and rapid as possible and not require any services such as electric or chemical supplies, so that it could be used in locations where these services would not be available.

Creep in tension at constant stress is a sensitive means of measuring the damage caused by ozone cracking. The cracks reduce the cross-sectional area of the specimen, thereby increasing the strain. The values for creep obtained in this manner would, however, also include ordinary creep. One means of differentiating between the two types of creep is to test two specimens simultaneously, with one subjected to air and ozone and the other protected from ozone, but in the presence of atmospheric oxygen. The difference between the values of strain as a function of time would be due to ozone cracking. Protection of a strand of rubber from ozone is easily accomplished since ozone diffuses very slowly

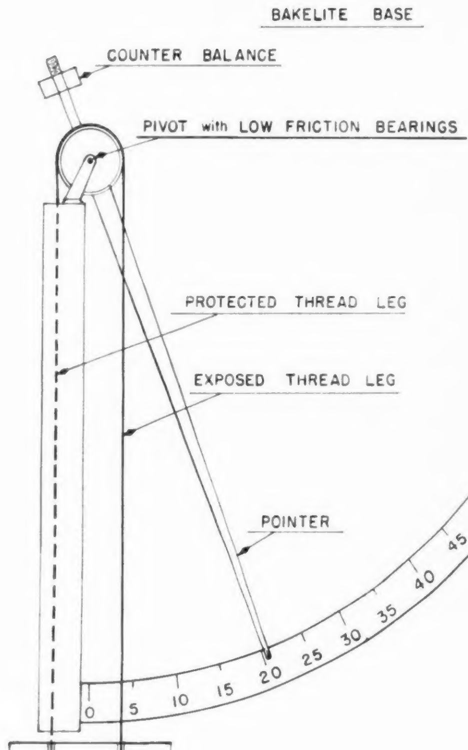


Fig. 1. Schematic Diagram of B. F. Goodrich Ozonometer

and is readily decomposed by cellulose materials. Protection may be accomplished by a narrow tube or enclosure, lined with ordinary blotting paper, open at the ends so that oxidation or other effects, if they occur, will be equivalent in both strands.

Description of the Instrument

To utilize the principle for measuring ozone attack discussed above, an instrument called the Ozonometer has been constructed. A diagram of the instrument is shown in Figure 1 and a photograph in Figure 2. It consists essentially of a low friction bearing pulley which maintains the stress equalized between the two legs of the single stretched rubber thread, one leg of which is subject to ozone attack, and one protected from ozone as described above. At the start of the test the stress in each leg is equal and remains so throughout, owing to the rotation of the pulley effecting a balance. The strain, however, varies from the initial elongation, being 97% of the original strain in the protected leg and 103% in the exposed leg at the maximum rotation of 45 degrees. This action, then, is creep under conditions of equal, but decreasing stress in the two legs of the rubber thread. Since the stress is identical in both legs, the difference in amount of creep is proportional to the reduction in cross-sectional area of the exposed leg. Cracking at the ends of the protecting enclosure is cancelled by that of the exposed leg. The effects of oxygen-induced creep and thread non-uniformity for all practical purposes are cancelled out by this arrangement.

[1] The B. F. Goodrich Co. Research Center, Brecksville, O.
[2] *J. Soc. Chem. Ind.*, 49, 168T (1930).
[3] *Kautschuk*, 7, 79, 115 (1931).
[4] India Rubber World, 125, 719 (1952).
[5] *Rubber Chem. Tech.*, 24, 750 (1951).

Estimating Low Concentrations of Ozone in Air

By **J. R. Beatty**[1] *and* **A. E. Juve**[1]

A simple, accurate, and objective method for the estimation of ozone in air based on the formation of cracks in rubber subjected to strain, has been developed. The differential creep of natural rubber thread, one-half of which is subject to ozone containing atmosphere, the other half protected from ozone, is a sensitive measure of the severity of ozone attack or cracking.

The B. F. Goodrich Ozonometer is a small, self-contained unit which may be operated in the horizontal or vertical position. The instrument may also be used for comparisons of the resistance of rubber compounds to ozone attack under conditions of controlled ozone concentration.

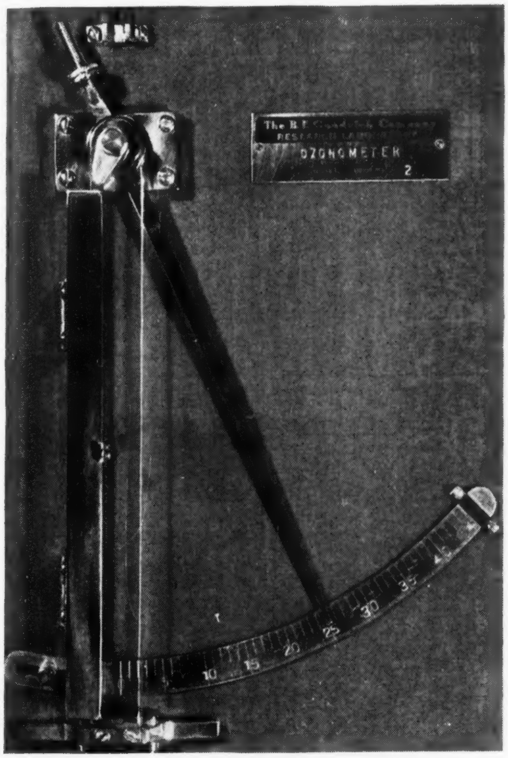


Fig. 2. Photo of B. F. Goodrich Ozonometer

The test specimen selected as the standard was a length of natural rubber golf ball thread having the dimensions 0.075-inch wide and 0.015-inch thick. This thread is readily available, is manufactured in a suitable form, and is uniform in modulus and dimensions. The bulk of the experimental work was done with 100% elongation of the thread.

Test Procedure

Directions for operating the instrument are as follows:

(1) Load the test strip of the proper length by clamping an end in each grip and stretching the strip over the pulley.

(2) Adjust the position of the pointer to the vicinity of the zero point.

(3) Deflect the pointer to the maximum deflection and allow it to swing freely to its balanced position to equalize the strain around the pulley.

(4) Close the protective door over one leg.

(5) Place in atmosphere to be tested (entire instrument must be at temperature equilibrium with surroundings).

(6) Vibrate the base lightly to overcome any bearing friction.

(7) Read the deflection indicated.

(8) Repeat steps (6) and (7) at intervals of five minutes more or less, depending on the rate of ozone attack. Twenty to 30 minutes' test time is sufficient for most purposes.

(9) Plot the best fitting straight line for the deflection *versus* time curve.

A typical curve for angular deflection *versus* time is shown in Figure 3 as obtained for a specific ozone concentration. The curves obtained are essentially straight lines for the test times considered, so that the slope of the curve, or degrees of deflection per minute, may be used as an indication of the severity of ozone attack.

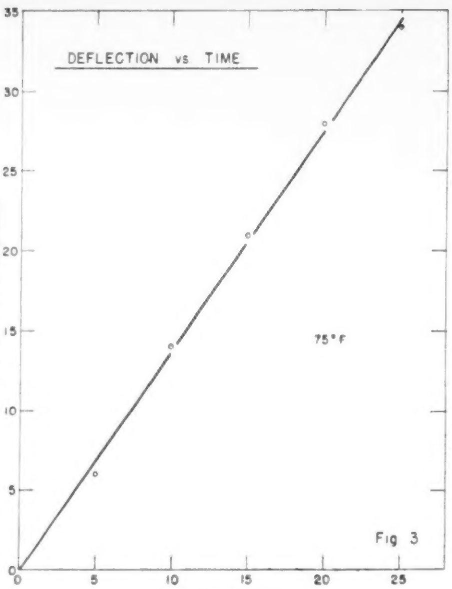
Calibration Equipment

In order to investigate the variables that affect the operation of the Ozonometer, the equipment shown in Figure 4 was constructed. It was also found useful in studying compounding variables at constant ozone concentrations. Laboratory compressed air, which was found to contain no ozone, was used to provide an ozone-free source of air for test purposes. It was ozonized to the desired extent by a generator consisting of four Westinghouse 794H "Sterilamps." Each lamp operates in series with a 40-watt incandescent lamp to provide the required voltage. The ozone lamps were enclosed in a glass cylinder through which a measured volume of air was passed. By varying the number of lamps in operation and/or the rate of air flow, the ozone output can be controlled. This generator gave a steady supply of ozonized air.

The test chamber used in this work was a glass jar, 18 inches in diameter by 12 inches high with a ground top edge. The lid was plate glass and had the ozone inlet and outlet as well as the stirring facilities attached to it. A seal was effected between it and the jar by silicone grease. It was found necessary to use mechanical stirring in addition to a simple dispersion tube to prevent stratification, as evidenced by smoke tests and Ozonometer readings. In addition, tests showed that besides the fan and dispersion tube a minimum flow rate of one cubic meter/hour of the ozonized air for this volume chamber was required to secure the same reaction on the Ozonometer as was found outdoors or in a good sized room indoors where convection currents and wind provide the circulation.

Effects of Test Variables

The calibration determined by use of the equipment described above with the standard golf ball thread is shown in Figure 5. It is seeen that the rate of deflection



(Left) Fig. 3. Angular Deflection *versus* Time for the Ozonometer

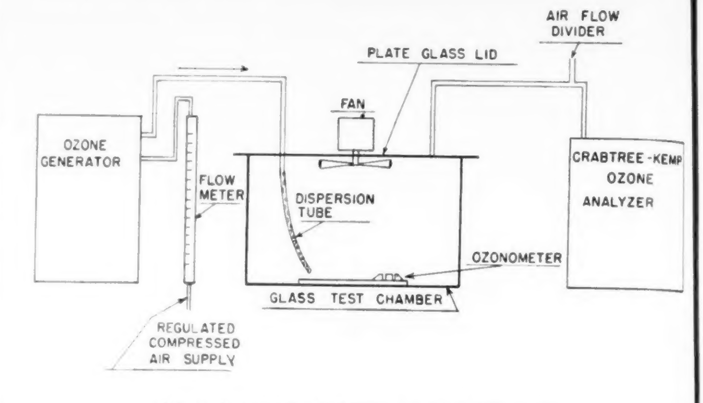


Fig. 4. Calibration Equipment for the Ozonometer

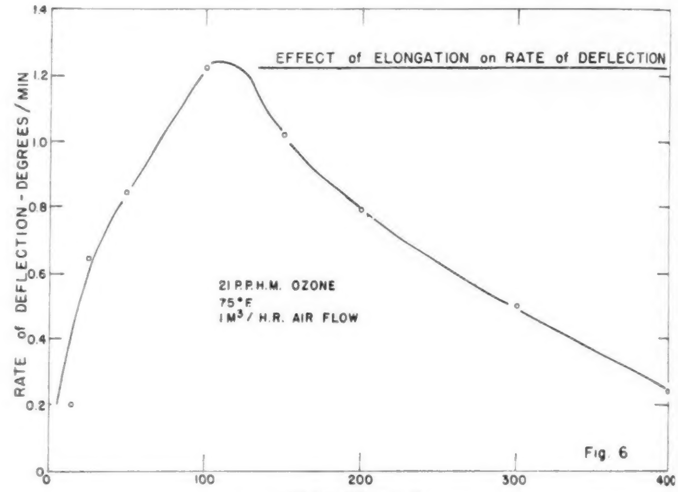
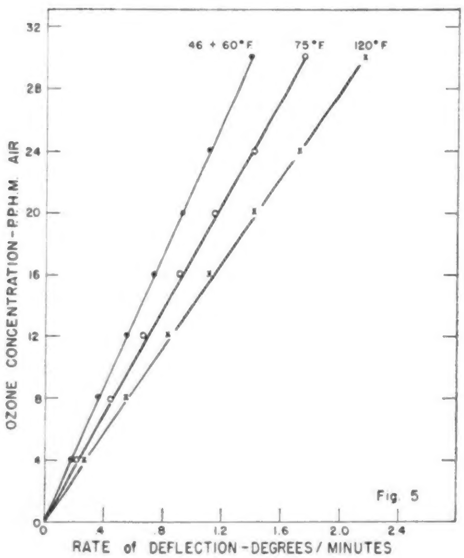


Fig. 6. Effect of Rubber Thread Elongation on Rate of Deflection



(Left) Fig. 5. Ozonometer Calibration Results at Different Temperatures

is a direct function of ozone concentration, as determined by the chemical method described by Crabtree and Kemp.[6] The effect of temperature agrees with the data of other investigations[5, 6] in that the severity of ozone attack increases directly with temperature.

To confirm that the reaction was due to ozone alone, tests were made in atmospheres of tank oxygen, lamp-grade nitrogen, or laboratory compressed air in the glass chamber. Since no deflections with the Ozonometer were observed in any of these cases, it was assumed that the angular deflection noted in ordinary and ozonized atmospheres was due to ozone. Another investigator[3] also confirmed these results for chlorine, nitrogen oxides, and sulfur dioxide in that no cracks were formed.

It was theorized that the effect of creep on the two legs of the specimen effectively cancels out. To check this, tests were made with both legs exposed to various atmospheres. No angular deflection of the pointer was noted even though those containing ozone caused cracks in both legs of the specimen.

[6] *Ind. Eng. Chem. (Anal. Ed.)*, 18, 769 (1946).
[7] J. R. Beatty, J. M. Davies, *J. Applied Phys.*, 20, 6, 533 (1949).

The effect of varying the thread elongation is shown in Figure 6. The maximum rate of deflection is at approximately 100% elongation for this particular rubber thread material. Higher modulus stocks have the maximum reaction at lower elongations. Ozone cracking studies have established that low elongations give large destructive cracks, but few in number; while high elongations give more numerous, but smaller cracks. Evidently the greatest reduction in cross-sectional area is found at an intermediate elongation, which for this low modulus material (golf ball thread) is about 100%. Other compounds of rubber will vary in this reaction, depending on their modulus.

It is possible that crystallization of the rubber sample limits the range of operating temperature in use of this instrument as an ozone concentration measuring device, since cooled and strained rubbers crystallize rapidly.[7] For the same reason elongations above 100% probably should be avoided in tests at room temperature.

The effect of humidity on the rate of deflection is shown in Figure 7. The rates of deflection were identical for relative humidities of 0, 10, and 46%. Relative humidity of 100% gave a slightly increased rate of deflection for a given ozone concentration.

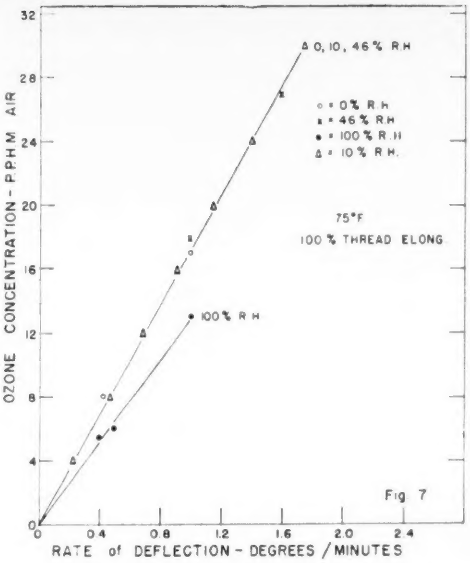


Fig. 7. Effect of Relative Humidity on Rate of Deflection

Table I. Ozonometer Calibration Sunlight and Shade

November 8, 1953—Weather Clear

	Sunlight				Shade		
Test No.	Machine No.	Defl. in 30′-Degrees	Temp. °C.	O_3 Conc. PPHM.	Defl. in 30′-Degrees	Temp. °C.	O_3 Conc. PPHM.
1	2	18.4	14	13	14.4	10	11
2	2	24.4	16	15	17.0	11	13
3	1	23.0	18	13	12.2	13	9
4	1	16.2	22	9	15.0	14	11
5	2	14.1	21	8	11.4	15	8
6	2	18.0	21	10	9.7	15	8
7	1	21.0	21	12	15.6	15	11
8	1	14.0	25	8	13.0	15	10

Av. O_3 concentration, 11 pphm. 10 pphm

In many instances direct sunlight has been observed to prevent the gross cracking due to ozone of stretched rubber and to produce a shallowly checked surface which after the onset of checking deteriorated slowly. From these observations it was a matter of some conjecture whether Ozonometer readings could be made in sunlight. The results obtained with the Ozonometer, however, were identical as to ozone concentration when the temperatures of the test strips were taken into consideration, as shown in Table 1. Measurements were made simultaneously with two machines side by side, one shaded, and the other in bright sunlight. These results are in agreement with those of a recent study.[5]

In outdoor tests the wind varies both as to direction and velocity, with direction having no appreciable effect. To determine the effect of air velocity on the Ozonometer, tests were made in the calibration chamber. Increasing the rate of flow of air through the calibration chamber approximates the effect of an increase in wind velocity.

In Figure 8 ozone concentrations measured by means of both the Ozonometer and chemical methods are plotted as a function of the rate of the ozonized air through the test chamber. Flow rates of one cubic meter/hour and above gave essentially equal results by both methods of measurement, but below one cubic meter/hour flow rate the Ozonometer readings were low, when compared with chemical measurements. The shape of the two

Fig. 8. Ozone Concentration *versus* Air Flow Rate; Ozone Measured by Ozonometer and by Chemical Means

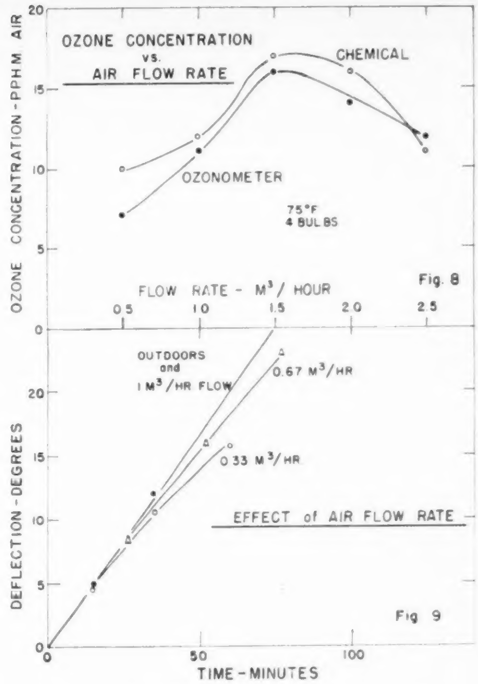


Fig. 9. Effect of Air Flow Rate on Deflection

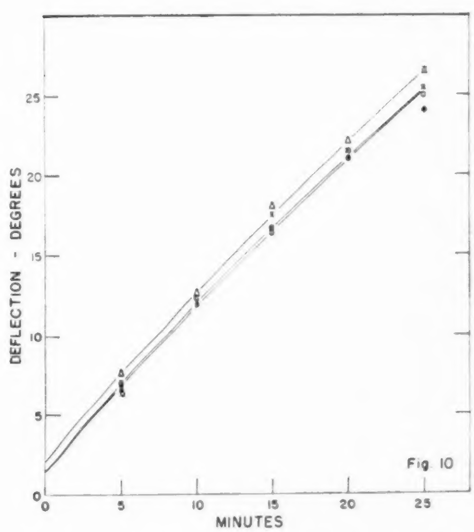


Fig. 10. Reproducibility of Deflection Results for a Given Lot of Rubber Thread

curves is due to the variation in ozone output resulting from the increased flow rate. Up to flow rates of 1.5 cubic meters/hour the efficiency of ozone production of the generator increases faster than the dilution effect. Flow rates above 1.5 cubic meter/hour show the dilution effect to predominate.

Results of outdoor tests using two Ozonometers are shown in Figure 9. One instrument was in the calibration chamber; the other nearby in the open air. Air was pumped through the calibration chamber at various rates, as shown on the graph. The deflections measured as a function of time showed that at flow rates below one cubic meter/hour the Ozonometer gave low deflec-

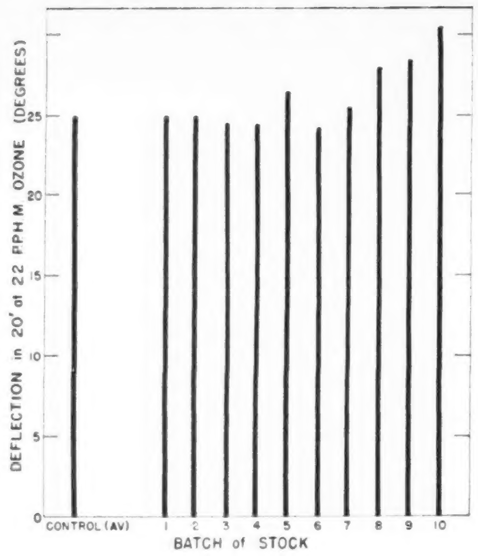


Fig. 11. Batch to Batch Rubber Thread Variation Effect on Deflection

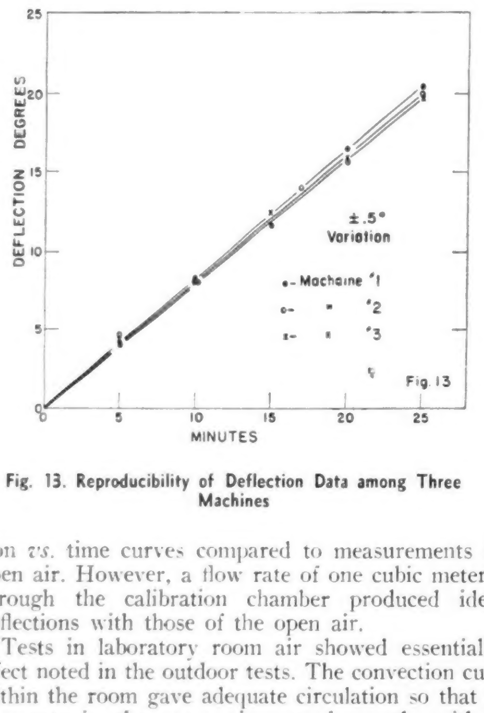


Fig. 13. Reproducibility of Deflection Data among Three Machines

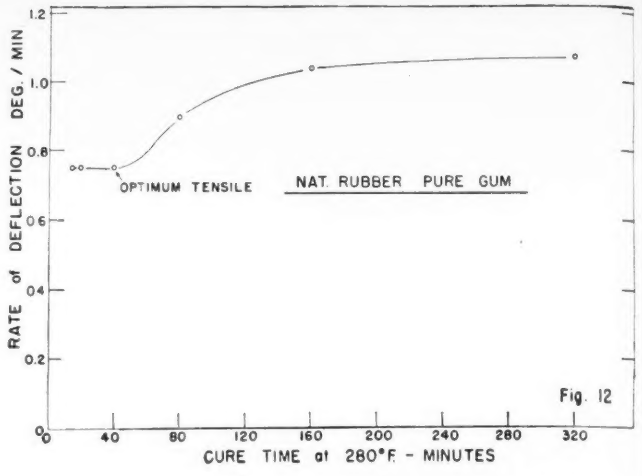


Fig. 12. Effect of Cure Time of Rubber Thread on Deflection Rate

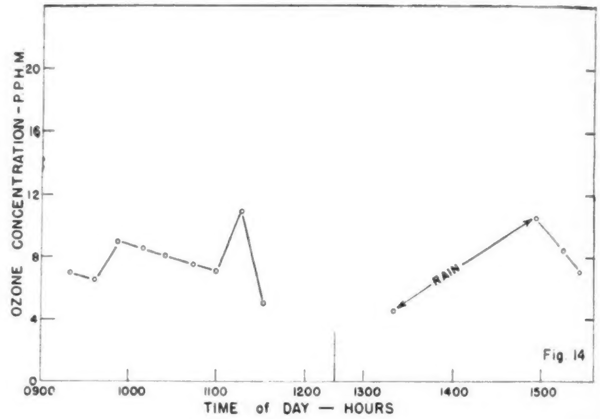


Fig. 14. Outdoor Ozone Concentration at Brecksville, O., for One Day as Measured by Ozonometer

tion *vs.* time curves compared to measurements in the open air. However, a flow rate of one cubic meter/hour through the calibration chamber produced identical deflections with those of the open air.

Tests in laboratory room air showed essentially the effect noted in the outdoor tests. The convection currents within the room gave adequate circulation so that measurements in the room air agreed exactly with those made in the calibration chamber with one cubic meter/hour of the room air passing through it.

These tests were made to determine the effect of air velocity on the operation of the Ozonometer as an ozone measuring device compared to chemical methods of analysis. The results indicate that wind velocity has no effect on Ozonometer measurements of ozone concentration. The data also show that low readings with the Ozonometer are probably due to poor dispersion of ozone in a closed chamber or stratification of the ozone in the atmosphere of the chamber.

The reproducibility of data for a given lot of thread is shown in Figure 10. Figure 11 shows results for 10 lots of thread taken at random from production. Seven of the 10 lots agree quite well; while three deviate somewhat more than is desirable. This deviation may be due to the state of cure.

Figure 12 shows the effect of cure time on the rate of deflection for a stock similar to the control. The rate of deflection is essentially constant until overcure, whereupon the rate of deflection increases, indicating more severe ozone attack.

The reproducibility of data among the three instruments of this laboratory is shown in Figure 13.

If the data for thread rubber and machine reproducibility are used in conjunction with the results of the chemical analysis and rate of deflection study, some idea of the correspondence of the determinations with the Ozonometer and those of the chemical method may be ascertained. From these data it would appear that the Ozonometer determinations correspond with and are as consistent as measurements by the chemical method. The accuracy of the chemical method is reported to be $\pm 5\%$[6] at ozone concentrations of 3 to 25 pphm. of ozone in air.

Applications of This Machine

There are two general types of use for which the Ozonometer is ideally suited. They are measuring ozone concentrations, and determining the resistance to ozone attack on strips of rubber compounds of various formulations under controlled conditions of ozone concentration.

Typical of the first use are the data shown in Figure

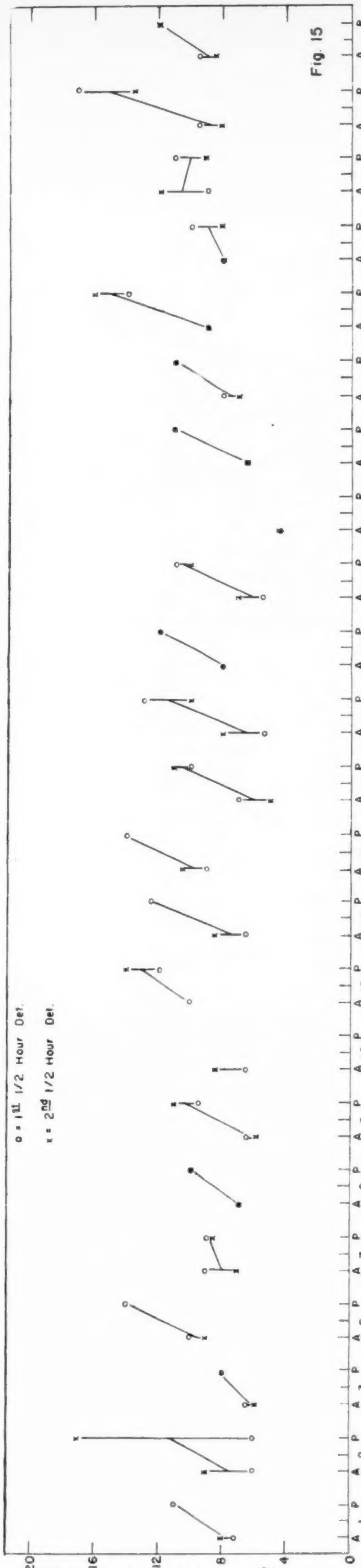


Fig. 15. Outdoor Ozone Concentration at Brecksville, July, 1954, as Measured by Ozonometer

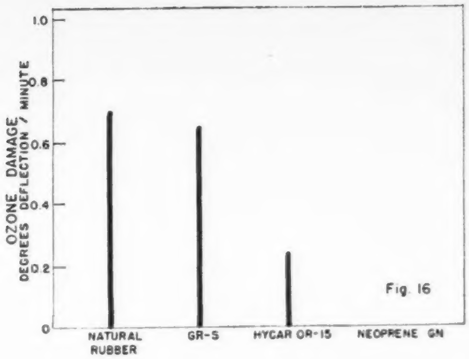


Fig. 16. Comparison of Rubber Polymers at Fixed Ozone Concentration by Means of Ozonometer

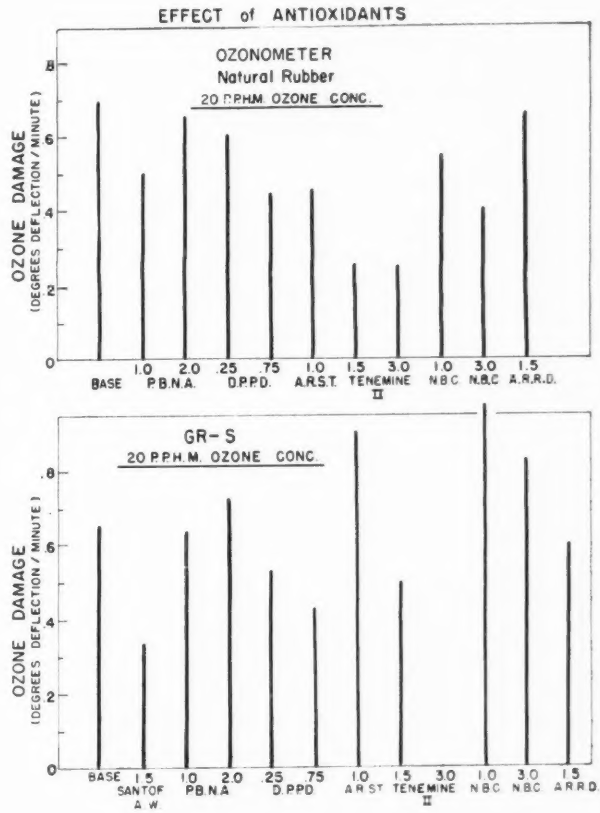


Fig. 17. Comparison of Effectiveness of Various Antioxidants in Natural Rubber and GR-S in Preventing Ozone Damage

Natural Rubber		GR-S	
Blended S. S.	100	L. T. polymer	100
Stearic acid	1	Zinc oxide	5
Zinc oxide	5	Tetramethyl thiuram disulfide	4
Altax*	1	Antioxidant variable	
Sulfur	2.5		
Antioxidant variable			

Abbreviation	Antioxidant
P.B.N.A.	Phenyl-beta-naphthylamine
D.P.P.D.	Diphenyl-p-phenylene diamine
N.B.C.	Nickel dibutyl dithiocarbamate
A.R.R.D.	AgeRite Resin D†
A.R.ST.	AgeRite Stalite†
SANTOF. A.W.	Santoflex AW‡

*2-2' Benzothiazyl disulfide.
†R. T. Vanderbilt Co., New York, N. Y.
‡Monsanto Chemical Co., St. Louis, Mo.

14 where ozone concentrations were measured just outside the Goodrich Research Center. Such data are of interest as they relate ozone concentration with the time of day and meteorological conditions. Morning and afternoon determinations of the ozone concentration outside the laboratory for the month of July are shown in Figure 15. The morning readings were taken at 8:30-9:30 a.m.; while the afternoon readings were at 3:15-4:15 p.m. Concentrations, in general, were found to be higher in the afternoon than in the morning. The range of ozone concentrations in this study was from four to 16 parts per hundred million air, which is considerably higher than has been reported in any location except near Los Angeles.

Typical of the second use are the data illustrated in Figures 16 and 17. Figure 16 summarizes the data for gum recipes of various polymers compared as to ozone resistance at 25 pphm., using 100% elongation of the rubber strip.

Figure 17 illustrates typical results for various antioxidants in natural rubber and GR-S. The base recipes are shown below, with an explanation of the abbreviations for the antioxidants used in Figure 17.

Summary

A simple, accurate, and objective method for the estimation of ozone concentrations in air has been developed. It is based on the well-known reaction of ozone on rubber subjected to strain: namely, the formation of cracks. The differential creep of a natural rubber thread, one-half of which is subject to the ozone containing atmosphere, the other half protected from ozone, is a sensitive measure of the severity of ozone attack or cracking. This differential creep or deflection is essentially linear with time at a given ozone concentration, and the rate of deflection is directly proportional to the ozone concentration. The variables of specimen, test machine, temperature, thread elongation, humidity, and sunlight were investigated.

The instrument, the B. F. Goodrich Ozonometer, is a small, self-contained unit which may be operated in the horizontal or vertical position. Two areas of usefulness for this method and machine exist.

1. Tests for ozone concentration in locations inaccessible to ordinary chemical methods by virtue of the equipment and services required.

2. Comparisons of the resistance of rubber compounds to ozone attack under conditions of controlled ozone concentration.

Synthetic Rubbers

(*Continued from page 224*)

large-scale production.

New knowledge has been gained and applied on different methods of agitation such as, for example, the propeller type *versus* Brumagim type.[5] Both the dry rubbers and the latices have been improved by using knowledge and experience obtained from this work. For example, X-617 type (a cord dip latex) has been made most satisfactorily with the Brumagim-type agitator at 212 revolutions per minute under a set angle of blade and a definite size and shape of reactor.

Continuous ploymerization (14) in a series of conventional reactors has been most successful in the manufacture of latex for dry rubber. This process, although it has shown promise, has not yet been proved satisfactory for large-scale manufacture of high solids latices for foamed rubber products.

Concentration of latex from low solids to high solids content has been fulfilled by vacuum flash apparatus and efficient temperature controlled heat exchangers. The revolving disk air circulating concentrator has not proved efficient for large-scale concentration to the 60% solids content. This equipment, however, is convenient and useful for laboratory use.

Emulsion-type polymerization reactions have been accelerated by irradiation with ultrasonic vibration (15). This method has not been carried beyond a laboratory scale.

Conclusion

Synthetic rubbers have become a necessity for continued progress. They have withstood varying economic conditions for sufficient time to develop large-scale use. The synthetic rubber oil masterbatch has been established on the basis of high quality and low cost.

The Olsen flow test helps select better polymers. By continued improvements in both synthetic and natural elastomers, we can conclude with the quotation from Browning, "The best is yet to be."

Acknowledgment

Results reported have come from many individuals, some of whom are mentioned in the references. The help of these people, particularly those in laboratories, plants, and management of The Goodyear Tire & Rubber Co., is gratefully acknowledged. The author wishes to express thanks to the Goodyear company, H. J. Osterhof, and R. P. Dinsmore for permission to publish this work.

Many of the synthetic rubber investigations reported herein were performed as part of a research project sponsored by Reconstruction Finance Corp., Office of Synthetic Rubber, in connection with the U. S. Government Synthetic Rubber Program.

Bibliography

(1) "The Microbiological Deterioration of Rubber Insulation," J. T. Blake, D. W. Kitchin, O. S. Pratt, *Trans. Am. Inst. Elec. Engrs.*, 72, III, 321 (1953).
J. T. Blake, D. W. Kitchin, *Ind. Eng. Chem.*, 41, 1633 (1949).
(2) I. J. Sjothun, P. S. Geer, *Rubber Age (N. Y.)*, 74, 231 (1953).
(3) J. D. D'Ianni, J. J. Hoesly P. S. Geer, *Ibid.*, 69, 317 (1951).
(4) F. S. Rostler, *Ibid.*, 69, 559 (551).
(5) R. P. Dinsmore, *Trans. Inst. Rubber Ind.*, 28, 166 (1952).
(6) G. H. Swart, E. S. Pfau, K. V. Weinstock, India RUBBER WORLD, 124, 309 (1951)).
(7) J. J. Hoesly, E. S. Teed, R. M. Pierson, R. W. Hobson, T. H. Rogers, D. W. Peabody, H. K. Foley, R. E. Workman, W. D. Wolfe S. D. Gehman, K. E. Gui, R. P. Clifford—private communications and U. S. Government road tests.
(8) I. M. Kolthoff, W. E. Harris, *J. Polymer Sci.*, 2, 72 (1947).
(9) French and Ewart, *Anal. Chem.*, 19, 165 (1947).
(10) E. J. Van Pelt, Office of Synthetic Rubber, Reconstruction Finance Corp., Washington, D. C.
(11) Bulletin No. 36, Tinius Olsen Testing Machine Co., Philadelphia, Pa. With chart drive made by Esterline-Angus Co., Inc. Indianapolis, Ind. (ASTM Test Method D569—American Society for Testing Materials, 1916 Race St., Philadelphia.)
(12) N. V. Seeger, T. G. Mastin, E. E. Fauser, F. S. Farson, A. F. Finelli, E. A. Sinclair, *Ind. Eng. Chem.*, 45, 2538 (1953).
(13) T. H. Rogers, H. H. Heineman, RUBBER WORLD, 130, 502 (1954).
(14) D. H. Francis, H. R. Sontag, *Chem. Eng. Progress*, 45, 402 (1949).
(15) A. S. Ostroski, R. B. Stambaugh, *J. Applied Phys.*, 21, 478 (1950).

[5] Brumagim-type agitators are manufactured by Struthers Wells Corp., Warren, Pa., under United States patent No. 2,235,604.

REPRINTS OF THE ARTICLE "ANTIOZIDants for GR-S Rubber," by R. F. Shaw, Z. T. Ossefort, and W. J. Touhey, U. S. Army Ordnance Corp., Rock Island Arsenal, which appeared in our August, 1954, issue, are available from RUBBER WORLD, at 10c a copy. *Editor.*

Weather Aging of Styrene and Phenolic Plastics[1]

By **C. H. Adams**[2] *and* **J. R. Taylor**[2]

THE use of plastic materials in applications where good outside weathering characteristics are required is increasing. The aircraft, automotive, communications, construction, and associated industries are only a few of those using plastics for outdoor applications in ever-increasing amounts. Examples of such uses are television antenna insulators, foam styrene lenses in microwave relay towers, reinforced plastic automobile bodies, and air conditioner housings.

Plastic materials in these and other outdoor applications must give dependable service over a wide range of environments. To aid the design engineer in the proper choice of plastic materials, data on the physical properties of the material, exposed outdoors for long periods of time, must be available. The weathering program presented in this report was undertaken to make available data on the physical properties of styrene and phenolic materials exposed outdoors at three locations for intervals up to and including four years.

Presented before the Rubber & Plastics Division, American Society of Mechanical Engineers, Pittsburgh, Pa., June 22, 1954.

[2] Research department, plastics division, Monsanto Chemical Co., Springfield, Mass.

[3] ASTM Standards on Plastics, May 1954, American Society for Testing Materials, 1916 Race St., Philadelphia, Pa.

Fig. 1. Specimen Exposure Rack at Springfield, Mass.

THE mechanical and electrical properties of unpigmented styrene were seriously degraded by outdoor exposure for three months. Weather resistance was improved by the addition of a pigment to the styrene, but the surface still yellowed considerably.

A black pigmented, wood-flour filled phenolic compound was degraded mechanically and electrically by semitropical weather exposure. Loss of weight of the exposed samples may be attributed largely to continued cure. Change in appearance was caused by surface erosion.

Test Program

Exposure Sites

The exposure sites were chosen so that warm dry, warm moist, and cyclical climates would be included. The three locations selected to cover the wide range of climatic conditions were Fort Lauderdale, Fla., Phoenix, Ariz., and Springfield, Mass. Fort Lauderdale was chosen because of its high temperatures, moderate to high rainfall, and high humidity; Phoenix, for its high temperatures, low rainfall, and low humidity; and Springfield for its extremes in summer and winter.

All weather data for each exposure site were obtained from the nearest U. S. Weather Bureau Station. The data plotted for Fort Lauderdale were recorded at Miami, a distance of approximately 40 miles from the exposure location. It was felt that since Miami and Fort Lauderdale were comparatively close together, the terrain between the two was flat, and both were located on the East Florida Coast, the average weather data would be the same for the two locations.

Data plotted for Springfield were taken at Brainard Field, Hartford, Conn., a distance again of about 40 miles from the specimen racks. Here the recording station and the exposure racks were in the Connecticut River Valley and close enough together so that the average weather data were the same for both.

Test Methods

The exposed specimens were tested, where possible, in accordance with standard ASTM[3] procedures. The tests used to show the effect of exposure on the mechanical properties were tensile strength and elongation (ASTM

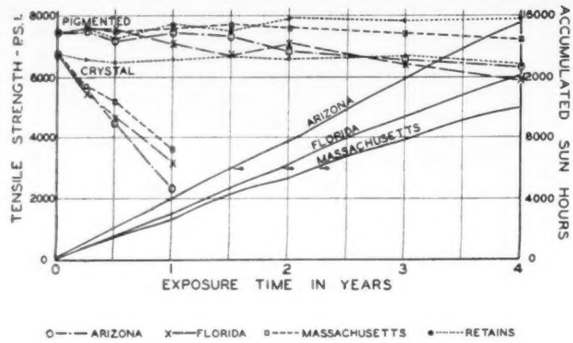


Fig. 2. Effect of Exposure Locations and Time on Tensile Properties of Styrene Specimens. Accumulated Sun-Hours at Each Location Are Also Shown. "Retains" Curve Is Control Sample Kept in Dark

D638-49T for styrene; ASTM D651-48 for phenolic), flexural strength and deflection (ASTM D790-45T), and impact strength (ASTM D256-47T).

Loss of weight owing to outdoor exposure was determined by percentage weight change. Changes in heat resistance of the weathered samples were shown by checking heat distortion temperatures (ASTM D648-45T). The effect of outdoor exposure on the electrical properties was determined by the change in dielectric constant and dissipation factor (ASTM D150-47T) and dielectric strength properties (ASTM D149-44).

The ASTM test method for dielectric strength measurements was not followed for styrene. The method adopted was as follows. The voltage across the test specimen was raised at a rate of 1,000 volts per second to the level of 50,000 volts and left at this stress for 600 seconds. The value recorded for breakdown was the time in seconds, if less than 600, to fail at 50,000 volts. This method was used because the maximum available voltage in the laboratory was 50,000.

Dimensional stability was determined by measuring a length before and after exposure. Water absorption was determined by ASTM D570-42.

Test Specimens

The exposure specimens were molded from crystal styrene; gray pigmented styrene; and a black pigmented, wood-flour filled, general-purpose phenolic. The two styrene materials were exposed to determine the effect of pigment on the weathering resistance of styrene. The wood-flour filled phenolic was chosen since it is the most widely used material in this generic family.

The styrene specimens were injection molded on an eight-ounce Reed-Prentice injection molding machine using a six-cavity physical testing die. The molding conditions were: cycle, 45/45 seconds; temperature, 400/400° F.; ram pressure, 800 psi.; nozzle temperature, high; and booster, 2½ seconds. The die was kept at 70° C.

The phenolic molding compound was preheated for six minutes at 89° C. and compression molded with a hand mold. The molding conditions were: temperature, 340° F.; cure time, six minutes; and pressure, 3,600 psi.

Three panels of samples were assembled for each exposure period, with one panel sent to each weathering location. There were seven exposure periods so that 21 panels, in all, were assembled. Standard ASTM specimens were used throughout.

The test specimens comprising a set for one panel are listed in Table 1.

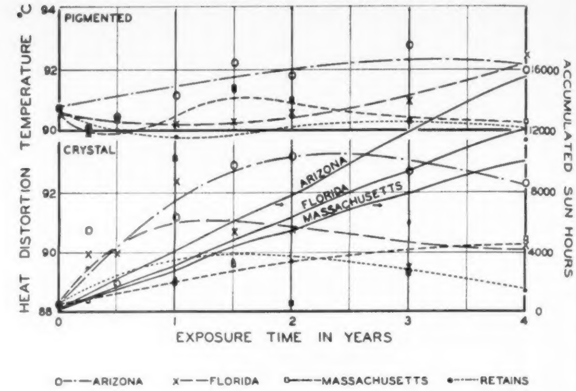


Fig. 3. Change of Styrene Heat Distortion Temperature upon Exposure at Three Locations. Accumulated Sun-Hours Are Also Shown. 'Retains' Curve Is Control Sample Kept in Dark

TABLE 1. TEST SPECIMENS

No. of Specimens	Specimen Size and Type	Test
Styrene (clear and pigmented)		
10	Tensile specimens	Tensile properties
10	5- × ½- × ½-inch bars	Heat distortion; impact strength
3	5- × ½- × ¼-inch bars	Flexural properties
3	4- × ⅛-inch disks	Dimensional changes; electrical properties
3	2- × ⅛-inch disks	Weight change; water absorption
Phenolic		
5	Dogbone tensile specimens	Tensile properties
10	5- × ½- × ½-inch bars	Dimensional changes; flexural properties; impact strength
3	4- × ⅛-inch disks	Dielectric strength
3	2- × ⅛-inch disks	Weight change; water absorption

The exposure plan was so designed that tests were made more frequently during the early stages of weathering. This plan was adopted so that the initial changes could be followed closely. Tests on the exposed samples were made at intervals of three, six, 12, 18, 24, 36, and 48 months. The assembled exposure panels were rigidly attached to racks inclined at 45 degrees from the vertical and facing south at each location (see Figure 1).

Control specimen sets identical in number to those exposed outdoors were kept in a laboratory having a standard atmosphere (23° C. and 50% relative humidity). These controls were tested in parallel with weathered sets.

All specimens were conditioned according to ASTM D618-47T prior to testing. The two-inch diameter disks used to determine weight change were not conditioned until after they had been weighed following aging. This plan was followed to prevent the weight change from being affected by factors other than outside weather. Any specimen with surface dust was wiped off with a dry cloth before being tested.

Test Results

The complete compilation of test data is presented in Tables 2, 3, and 4.

Styrene Tests

Data on exposure tests of crystal and pigmented styrene are given in Tables 2 and 3, respectively.

TABLE 2. WEATHERING DATA FOR CRYSTAL STYRENE PLASTIC

		Exposure Time, Months							
	Location	0	3	6	12	18	24	36	48
Tensile strength, psi.	Arizona	6700	5600	4500	2300	—	—	—	—
	Florida	6700	5400	4700	3200	—	—	—	—
	Mass.	6700	5700	5200	3600	—	—	—	—
	(Control)	6700	6600	6500	6600	6700	6600	6700	6400
Tensile elongation, %	Arizona	1.55	1.20	1.00	0.50	—	—	—	—
	Florida	1.55	1.17	1.07	0.70	—	—	—	—
	Mass.	1.55	1.25	1.17	0.75	—	—	—	—
	(Control)	1.55	1.55	1.45	1.5	1.47	1.52	1.45	1.35
Flexural strength, psi.	Arizona	11300	5700	5300	5400	3400	3200	1950	1600
	Florida	11300	7800	4800	3850	3850	3300	2200	1700
	Mass.	11300	9000	7500	5400	4800	4400	4000	1500
	(Control)	11300	11100	10900	11700	11300	11250	9700	10600
Flexural deflection, in.	Arizona	0.24	0.11	0.11	0.11	0.08	0.08	0.05	0.04
	Florida	0.24	0.15	0.10	0.09	0.09	0.09	0.06	0.05
	Mass.	0.24	0.16	0.15	0.11	0.11	0.11	0.09	0.07
	(Control)	0.24	0.24	0.23	0.26	0.25	0.25	0.22	0.23
Izod impact, ft.-lbs. in.	Arizona	0.28	0.21	0.19	0.24	0.32	0.22	0.21	0.22
	Florida	0.28	0.18	0.22	0.26	0.27	0.22	0.22	0.22
	Mass.	0.28	0.19	0.25	0.32	0.34	0.25	0.30	0.24
	(Control)	0.28	0.20	0.20	0.32	0.38	0.28	0.34	0.33
Heat distortion temp., °C.	Arizona	88.3	90.8	89.0	91.2	92.9	93.2	92.7	92.3
	Florida	88.3	90.0	90.0	92.5	90.7	90.8	89.5	90.3
	Mass.	88.3	88.4	—	89.0	89.6	88.3	89.3	90.5
	(Control)	88.3	89.5	—	89.1	89.8	89.7	91.0	88.7
Water absorption, %	Arizona	0.050	0.069	0.053	0.060	0.022	0.057	0.056	0.004
	Florida	0.050	0.070	0.057	0.040	0.040	0.047	0.057	0.041
	Mass.	0.050	—	0.053	0.065	0.080	0.073	0.064	0.043
	(Control)	0.050	—	0.047	0.053	0.050	0.037	0.037	0.06
Weight change, %	Arizona	0.00	+0.20	+0.15	+0.10	−0.23	−0.55	−1.12	−1.75
	Florida	0.00	+0.15	+0.10	+0.15	−0.55	−0.90	−1.80	−2.57
	Mass.	0.00	—	+0.15	+0.15	−0.05	−0.20	−0.60	−1.05
	(Control)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dissipation factor (at one Kc.)	Arizona	0.00015	0.00037	0.00030	0.00032	0.00045	0.00041	0.00049	0.00100
	Florida	0.00015	0.00019	0.00040	0.00036	0.00052	0.00054	0.00056	0.00125
	Mass.	0.00015	0.00026	0.00028	0.00038	0.00039	0.00044	0.00054	0.00102
	(Control)	0.00015	—	0.00012	0.00012	0.00010	0.00018	0.00024	0.00012

Three months' exposure at each location caused serious degradation of the crystal styrene, as evidenced by pronounced yellowing and crazing. The Arizona location was by far the most severe (see Figure 2), and tensile specimens exposed at Phoenix were too brittle to test after 12 months' exposure. The loss of both tensile and flexural strength with aging is directly related to the amount of sunshine (ultra-violet radiation) falling on the material.

Pigmentation of the crystal styrene to an opaque gray gave a weather resistant material showing little change in strength with four years' exposure. The action of the pigment is thought to be a combination of light reflection (the controlling factor), scattering, and absorption.

The heat distortion temperature showed a tendency to increase with exposure time at all locations, as shown in Figure 3. This action appears to be due to the annealing action of the sun's radiation. The fact that Arizona exposure causes the greatest increase seems to verify this observation, as does the higher rate of increase for the crystal material compared with the pigmented styrene. The more complete annealing of the crystal styrene is related to its greater transparency to infrared radiation.

Curves of weight loss of styrene specimens in terms of exposure times and locations are shown in Figure 4. Erosion and evaporation of residual monomer are felt to be the prime causes for this loss in weight of exposed samples. Florida exposure caused the greatest change, with moderate erosion (because of heavy rainfall) and monomer evaporation (because of infrared heating) accounting for the loss. Arizona specimens showed the next highest loss, and, here, the predominating effect was felt to be monomer evaporation. Springfield weather was the least severe in this test.

Dielectric properties (dielectric constant, dissipation factor, and dielectric strength) of both crystal and pigmented styrene deteriorated with outdoor exposure. There was a wide spread in the dielectric strength results, but the reasons for this variability are unknown. As was the case for other properties, crystal styrene was degraded appreciably more than the pigmented material. The Florida location with its high rainfall, relative humidity, and temperature was the worst exposure. These exposure conditions are thought to be related to moisture absorption in voids created by surface erosion.

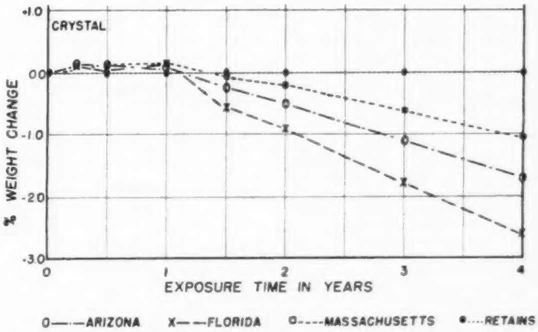


Fig. 4. Change in Weight of Styrene upon Aging at Three Locations. "Retains" Curve Is Control Sample Kept in Dark

Impact strength showed no significant trends with regard to material or location factors. This result is due in part to the fact that the specimens were notched after exposure; i.e., the weathered skin was cut away during notching.

No trend was established for water absorption behavior in the test program.

TABLE 3. WEATHERING DATA FOR GRAY PIGMENTED STYRENE PLASTIC

	Location	Exposure Time, Months 0	3	6	12	18	24	36	48
Tensile strength, psi	Arizona	7500	7500	7200	7400	7300	6800	6600	6300
	Florida	7500	7500	7600	7100	6700	7100	6400	5900
	Mass.	7500	7600	7500	7600	7700	7600	7400	7200
	(Control)	7500	7600	7300	7800	7500	7900	7800	7900
Tensile elongation, %	Arizona	2.15	1.90	1.75	1.90	1.85	1.60	1.47	1.30
	Florida	2.15	1.82	1.95	1.75	1.60	1.60	1.40	1.20
	Mass.	2.15	2.02	2.10	2.10	1.90	2.00	1.70	1.55
	(Control)	2.15	2.10	1.97	2.17	2.12	2.15	2.12	2.12
Flexural strength, psi	Arizona	11900	10200	9900	9800	9900	8700	7700	8400
	Florida	11900	9700	10300	9400	9200	8700	6100	7300
	Mass.	11900	9900	11300	10000	8200	9200	9500	7000
	(Control)	11900	—	12900	13400	13600	13200	13300	13300
Flexural deflection, in	Arizona	0.24	0.20	0.21	0.22	0.20	0.19	0.16	0.18
	Florida	0.24	0.19	0.22	0.20	0.19	0.18	0.12	0.16
	Mass.	0.24	0.20	0.24	0.21	0.17	0.20	0.20	0.14
	(Control)	0.24	—	0.33	0.36	0.38	0.34	0.35	0.32
Izod impact, ft.-lbs./in.	Arizona	0.19	0.19	0.20	0.25	0.39	0.25	0.26	0.23
	Florida	0.19	0.19	0.19	0.36	0.38	0.28	0.27	0.25
	Mass.	0.19	0.20	0.22	0.37	0.36	0.28	0.28	0.22
	(Control)	0.19	—	0.17	0.33	0.36	0.22	0.26	0.28
Heat distortion temp. °C.	Arizona	90.8	90.1	90.5	91.2	92.2	91.8	92.8	92.0
	Florida	90.8	89.9	90.4	90.2	90.3	90.6	91.0	92.5
	Mass.	90.8	89.8	90.3	89.1	91.4	91.0	90.3	90.3
	(Control)	90.8	90.1	90.0	89.8	91.3	90.5	90.3	89.7
Dissipation factor (at one Kc.)	Arizona	0.00077	0.00064	0.00032	0.00044	0.00038	0.00075	0.00040	0.00082
	Florida	0.00077	0.00064	0.00038	0.00054	0.00070	0.00090	0.00088	0.00160
	Mass.	0.00077	0.00075	0.00034	0.00059	0.00056	0.00056	0.00056	0.00098
	(Control)	0.00077	0.00076	0.00046	0.00054	0.00049	0.00067	0.00059	0.00072

TABLE 4. WEATHERING DATA FOR WOOD-FLOUR FILLED PHENOLIC (BLACK PIGMENTED)

	Location	Exposure Time, Months 0	3	6	12	18	24	36	48
Tensile strength, psi	Arizona	5900	5600	5800	5900	7100	5600	5400	4700
	Florida	5900	4750	4650	4800	4850	4300	3750	3700
	Mass.	5900	5500	5000	5070	5350	5500	4600	4600
	(Control)	5900	—	6250	7500	6200	6000	6600	5700
Flexural strength, psi	Arizona	8900	9000	9100	9350	9650	10000	9500	8350
	Florida	8900	6950	6800	7950	7400	7700	6400	6550
	Mass.	8900	7750	7800	8500	7950	9050	8100	7250
	(Control)	8900	—	9300	11450	9400	9950	9400	9000
Flexural deflection, in	Arizona	0.042	0.042	0.041	0.042	0.041	0.045	0.043	0.036
	Florida	0.042	0.032	0.032	0.039	0.038	0.037	0.031	0.029
	Mass.	0.042	0.035	0.036	0.038	0.038	0.044	0.040	0.033
	(Control)	0.042	—	0.045	0.056	0.043	0.048	0.043	0.041
Izod impact, ft.-lbs./in.	Arizona	0.32	0.34	0.32	0.33	0.38	0.32	0.41	0.45
	Florida	0.32	0.31	0.28	0.28	0.32	0.27	0.29	0.29
	Mass.	0.32	0.32	0.32	0.32	0.37	0.30	0.32	0.28
	(Control)	0.32	—	0.32	0.31	0.35	0.30	0.33	0.36
Weight change, %	Arizona	0.00	−0.22	−0.64	+0.80	−1.32	−1.10	−1.77	−1.90
	Florida	0.00	+1.20	+0.96	+0.76	0.00	−0.15	−0.83	−1.62
	Mass.	0.00	—	+0.60	+0.72	0.00	+0.50	+0.15	−0.54
	(Control)	0.00	—	+0.40	+0.32	+0.40	+0.64	+0.65	+0.75
Water absorption, %	Arizona	5.4	5.4	7.0	5.3	5.6	6.9	6.4	6.3
	Florida	5.4	7.0	7.5	6.5	8.2	8.3	9.3	7.9
	Mass.	5.4	—	6.2	6.8	7.9	7.4	7.8	6.9
	(Control)	5.4	—	6.9	4.8	6.0	5.4	5.5	4.4
Dielectric strength (volts/mil.) (short time)	Arizona	400	405	—	385	380	380	355	385
	Florida	400	360	—	290	235	225	235	280
	Mass.	400	375	—	300	290	270	255	320
	(Control)	400	385	—	350	335	285	300	360
Dielectric strength (volts/mil.) step by step	Arizona	290	270	—	275	285	300	300	305
	Florida	290	245	—	200	175	205	200	160
	Mass.	290	260	—	200	220	240	225	192
	(Control)	290	280	—	245	235	225	245	255

The control specimens, retained in the dark in a standard ASTM atmosphere, show no significant change in the level of any physical property during the four years the program was in progress.

Phenolic Tests

Exposure test data for the phenolic specimens are given in Table 4. Gain or loss of moisture, and chemical degradation are probably the two most important mechanisms responsible for the observed mechanical behavior of phenolic specimens exposed to outdoor weathering. Moisture has a plasticizing effect on the plastic. During the molding or curing operation, water is released by the condensation reaction. A portion of this water is trapped in the material.

During outside exposure the initial level of moisture content will vary, depending on the average temperature

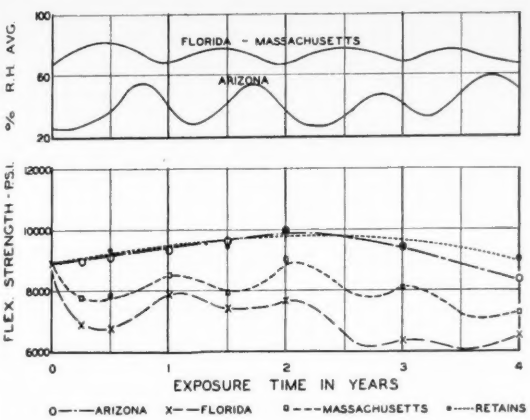


Fig. 5. Effect of Exposure Time and Relative Humidity on Flexural Strength of Phenolic Specimens. "Retains" Curve Is Control Sample Kept in Dark

of the specimen and the average relative humidity of the surrounding atmosphere. A gain in moisture will lower strength and increase ductility; while a decrease in moisture will have the opposite effect.

The high relative humidities in Massachusetts and Florida account for a substantial part of the observed loss in strength; and Figure 5 indicates a seasonal strength trend that is related to the humidity level. The overall downward trend of the strength properties at all locations is indicative of chemical degradation due in part to ultra-violet radiation.

Weight change of phenolic is related to evaporation of residual volatiles (primarily water), possible continued cure, and erosion. Evaporation and erosion are thought to be the dominant factors. Specimens weathered in Arizona, where the relative humidity and rainfall were low, lost weight mainly by evaporation. The losses in Massachusetts and Florida are postulated to be due primarily to erosion. The increase in weight of the retained samples was simply the result of moisture pick-up.

Water absorption appears to be a function of the surface condition of the sample. Thus, where erosion took place to an appreciable extent, the water absorption was high. Specimens exposed in Florida showed the greatest water absorption, with Massachusetts next and Arizona last.

Dielectric strength data showed Florida weather to be the most damaging, with Massachusetts next in severity. Specimens exposed in Arizona evidenced little or no change in this property. An increase in moisture content of a phenolic molding compound of this type generally lowers the dielectric strength. From the previous discussion it can be assumed that specimens aged in Florida and Massachusetts picked up significant amounts of moisture; while those aged in Arizona had gained very little. The retains were consistent with this predicted relation.

Summary and Conclusions

The weather elements contributing most to the degradation of the exposed specimens appeared to be ultra-violet radiation, humidity, rain and dust erosion, and temperature. In general, Florida weather was the most damaging to the physical properties of both styrenes and the phenolic material.

The mechanical and electrical properties of unpigmented styrene were seriously degraded by exposure to outdoor weather for a period as short as three months. The degree of degradation was closely related with the amount of sunlight reaching the specimen. The weather resistance was significantly improved by the addition of a pigment to the styrene. The surfaces of both types of styrenes were roughened by erosion after four years of exposure. Although the strength properties of the pigmented styrene showed little change over this period, the surface had yellowed considerably.

The phenolic compound (a black pigmented, wood-flour filled material) was degraded mechanically and electrically by semi-tropical weather (high humidity, high temperatures, and moderate rainfall). As would be predicted, specimens aged in a hot dry climate showed no appreciable changes in strength and electrical properties during the exposure period. The loss of weight of the exposed samples may be attributed largely to continued cure; while the change in appearance was caused by surface erosion.

Meetings and Reports

SPE Sections Report on Monthly Meetings

New York Section Hears Buyers' Panel

The problems encountered by buyers of plastic products was the general topic under discussion at the October 20 meeting of the New York Section, Society of Plastics Engineers, held at the Gotham Hotel, New York, N. Y. Members of the panel included Miss Goldie Kopelman, housewares buyer for Bloomingdale's department store; H. Katz, purchasing agent, Emerson Radio & Phonograph Corp.; and Monte Levin, industrial designer.

Miss Kopelman presented the direct retailer-to-consumer point of view and stressed the importance of trade-marked plastic products. The great variety of chemical names of plastics, she said, means very little to the average female purchaser and tends to create buyer resistance. She urged that even plastics in low-cost items be dignified by easily remembered names. Improved colorations were also needed in the industry, she asserted, as well as general product improvement.

Mr. Katz discussed some of the pitfalls encountered in his long-time relations with molders and how he set about choosing the right molder for a particular job. Very often, he said, he refused the offer of a molder who was willing to do the job at a temptingly low margin of profit. The cooperation so needed in smooth business relations, in such things as retrieving sub-standard items or accepting suggestions for minor changes in material or design, was not always forthcoming from these manufacturers, he asserted.

Mr. Levin traced the pattern of his responsibilities as industrial designer from his initial contact with industrial buyers to the final production of the item. An important facet of his task, he said, often was to design an item that can be produced in both low-cost and expensive models from the same mold facilities. The use of this technique, he pointed out, severely cuts the manufacturing cost of the higher-priced model and disproportionately boosts its margin of profit.

The 125 members and guests present at the meeting engaged in a vigorous question-and-answer period following the addresses. Predominantly molders, engineers, and salesmen, they encountered many of the off-hand criticisms leveled at them by the speakers and delineated the problems forced upon them by the contradictory demands of manufacturers, retailers, and consumers.

Moderator for the evening was Stanley Bindman, Jamison Plastics, Inc., who introduced the speakers, following the cocktail hour and dinner. Harold Schwartz, chair-

man of the New York Section; Palmer Humphrey, secretary; and Bill Lewi, vice president, presided over the business portion of the evening's activities. Joe Healy congratulated the organization on its ever-increasing membership and on its salutary role in the American plastics industry. Progress of the Section's educational program to insure an adequate supply of technicians for the industry was discussed by other members.

Reinforced Plastics Group Meets

The Reinforced Plastics Group of the SPE New York Section held its second regular meeting on September 29 at McGinnis' Restaurant, Jamaica, L. I., N. Y. Some 60 members and guests attended the meeting, which consisted of a cocktail hour, dinner, and technical session. Speakers at the technical meeting included Robert G. Nelb, Naugatuck Chemical Division of United States Rubber Co., who discussed "Chemistry of Polyester Resins," and Walter Brenner, East Coast Aeronautics, Inc., who spoke on "Plastics for Plastic Tooling."

Mr. Nelb gave an interesting discussion and review of reinforced polyester plastics, including the resin component, glass reinforcement, filler materials, curing, and fabricating methods. He stressed that the reinforced plastics industry is now at a crossroads that will determine its future growth. We need better and faster methods of fabricating the resins now available, rather than the further development of many new resins, the speaker stated.

Dr. Brenner noted that plastic tools provide simplicity of manufacture, ease of repair and maintenance, weight reductions, greater design freedom, and economic small-production runs. Such tools should not be used for a specific application, however, unless they provide some significant advantage in the application. Tools can be made from phenolic casting compounds, epoxy casting compounds, epoxy laminates, or polyester laminates. The use of plastic tools is presently limited to applications where temperature does not exceed 200° F. and pressure is not higher than 100 psi. These conditions apply in hand lay-up and bag molding operations. Results to date in press molding operations do not warrant general adoption of plastic tools, Dr. Brenner declared, but expected improvements in tooling materials should greatly widen their future range of applications.

Three Speakers Address Newark Section

The Newark Section, SPE, meeting October 13, heard Winslow A. Ward and William Sloatman, of American Cyanamid Co., discussing "Ureas, Melamines, and Melamine Laminates," and Robert J. Prochaska, General Electric Co., who talked on "Irradiated Polyethylene."

The history of the ureas and melamines, the techniques employed to produce them, and their commercial and industrial applications were topics covered by Mr. Ward and Mr. Sloatman. Slides and sample products illustrated their texts.

Dr. Prochaska described the work being done at General Electric on Irrathene 101, produced by bombarding polyethylene with high-energy electrons. Some of the properties attributed to this material include resistance to stress cracking, resemblance to a thermosetting plastic, and ability to perform like vulcanized rubber when subjected to heats greater than the normal melting point of polyethylene.

Progress of the Section's attempt to establish a three-year training course in plastics technology at the Newark College of Engineering was reported on during the business session. A trial-run of the course will be conducted at the evening school of the College to determine the extent of its acceptance.

Buffalo Section Hears Bergren

William V. Bergren, supervisor of time and motion study at The Carborundum Co., Niagara Falls, N. Y., delivered a talk on methods improvement to the Buffalo Section, SPE, September 17. He defined his subject as the act of finding the one best way of performing a job with the most economical use of manpower and equipment.

Such a program, he said, if carried out objectively, inevitably leads to reduced production costs, improved quality, better customer service, and higher plant efficiency. Mr. Bergren's lecture was based on the text of a course of instruction given to management officials at Carborundum which produced desirable results.

He suggested the following five steps as constituting a good approach to the problem of methods improvement: select the operation to be improved; break down the operation; analyze the operation; develop the new method; and install the new method. He stressed, however, that only a genuinely unbiased approach could make this program effective.

Balanced Gating Discussed by Jones

The season's first meeting of the Philadelphia Section, SPE, held at the Franklin Institute, Philadelphia, Pa., October 28, was addressed by David Jones, Celanese Corp. of America, New York, N. Y., whose subject was "The Theoretical Determination of Restricted Gate Size for Injection Mold Design to Effect Balance Gating."

In presenting an original formula for balanced gate value, Mr. Jones established a relation among units of land length, gate area, and length of runner. The assmuption of a reasonable land length, he said, should allow the calculation of a gate area to give balanced gating. The real value of this, he added, is that only one guess has to be made instead of two, and any error in that guess will be compensated for by the balanced gate value.

Miami Valley Section Meets

The Miami Valley Section, SPE, meeting, October 14, at Eaton Manor, Hamilton, O., heard an address by Sanford Zimmerman, Vacuum Forming Corp., on the vacuum forming of thermoplastic sheets. The various techniques and machines now being used in the plastics industry were covered in the talk. The 64 members and guests participated in the question-and-answer period that followed.

Cleveland-Akron Hears Swan, Schimmel

The SPE Cleveland-Akron Section's meeting September 20 at Brecksville, O., was addressed by Donald R. Swan, Pittsburgh Plate Glass Co., Cleveland, O., and Milton T. Schimmel, Conforming Matrix Corp., Toledo, O. Approximately 70 members and guests were in attendance.

Dr. Swan, speaking on "The Decoration of Plastics," pointed out that a finish was applied to rubber and plastics items to decorate, protect, or up-grade them. Detailing specific applications in the automotive and toy fields, he stated that every article was unique and called for individual consideration.

Mr. Schimmel, discussing "The Masking and Spraying of Decorated Plastics," said that the dimensional stability of the plastic material was the most important factor governing use of spray masks for plastic moldings, and for this reason most masked finishings were applied to acrylic plastics. The three basic types of masks, lip, plug, and cut-out, were exhibited and described.

Klinger Addresses California Section

The Southern California Section, SPE, which met October 7 at Los Angeles, Calif., was addressed by Rubin Klinger, Molder's Service Co., on "Uniformity of Loading," in which he discussed the advantages of weight-feeding over volumetric-feeding.

According to Mr. Klinger, such advantages include elimination of part-weight variations, saving of material, and cutting down on packing and sticking in the mold, resulting in higher quality of the molded part, fewer rejects, better dimensional tolerances, and less wear on pumps, presses, and molds.

Upper Midwest SPE Hears Bradt

The Upper Midwest Section, SPE, meeting September 20 at Minneapolis, Minn., was addressed by Rex Bradt, Fiberfil Corp., on "Injection Molding of Fiberglas-Filled Polystyrene." The business session of the group was devoted to a discussion of the organization's educational survey of the industrial requirements for plastics technicians and engineers and existing scholastic facilities.

According to Mr. Bradt, the value of polystyrene in fiber-glass materials is due to its low specific gravity, rigidity, and chemical resistance. In molding, the material should be predried, and injection into plated molds should be achieved rapidly. Although glass-impregnated polystyrene has many applications, he said, including toys, vacuum cleaner housings, camera cases, and film, it is not recommended for electrical equipment or for outdoor uses.

Brewery Tour for October Session

A tour of Hamm's Brewery, a Smorgasbord repast, and the viewing of sports films were enjoyed by the Upper Midwest Section, SPE, at its meeting, October 18. Jerome Formo is national director of the group.

Commercial Standard CS192-53 Clarified

A clarification of the text of Commercial Standard CS192-53, "General Purpose Vinyl Plastic Film," has been issued by the Commodity Standards Division of the United States Department of Commerce, Washington, D. C. To be added to paragraph 5.2 of the Standard, the addition reads as follows:

"Whenever the hallmark is shown on vinyl film, the hallmark shall include an indication of the gage of the film on which it is applied."

The change had been recommended by several producers and distributors who thought that the indication of the gage, originally omitted from the text, was important for the purchaser.

Scientific and Technical Activities

Tracerlab Symposium on Applications of Radioactivity in the Rubber and Plastic Industries

Tracerlab, Inc., one of the leading manufacturers of equipment for using radioactivity, sponsored a three-day symposium at the Sheraton-Plaza Hotel, Boston, Mass., October 6-8. Constructive projects with radioactivity and atomic energy connected with rubber and plastics were thoroughly explored in the papers and discussions. There was ample evidence that many distinctive uses for radioactivity which are just beginning to be exploited exist in these industries.

To set up a background of general information on the properties, possibilities, and limitations of radioactivity, the talks on the first day dealt with the role of the Atomic Energy Commission in the industrial use of radioactivity, health and safety considerations, instrumentation, radioisotope laboratories, and available isotopes and labeled compounds.

General Considerations

P. C. Aebersold, Chief of the Isotopes Division, Atomic Energy Commission, Oak Ridge, Tenn., explained the cooperative activities of the government with industry to promote and foster the use of isotopes and at the same time exert what controls are necessary in the interest of public health. Training courses at Oak Ridge in isotope techniques and radiological safety have been effective in giving industrial personnel adequate training for much of this work.

Information services of various types, such as the Technical Information Service and the Industrial Information Branch, have been established with the ends in view that industry should know how to procure radioactive materials and use them safely, what the AEC is doing which might be useful, and what others are doing in the field. The safety responsibilities of the AEC are discharged through a carefully developed licensing procedure involving the application of a prospective user to procure the desired material. The authorization is issued if there is reasonable certainty that the use will be safe to personnel and public. This procedure is workable as is shown by the fact that more than 50,000 shipments of radioisotopes have gone to more than 2,200 industrial, medical, and research institutions. About 1,000 industrial firms are now securing isotopes for various purposes.

Health and safety considerations were discussed by C. R. Williams, of Liberty Mutual Insurace Co. There are two broad classes of hazards, exposure to radiation and inhalation or ingestion of radioactive materials. Shielding and distance are the usual protections from radiation, with appropriate instrumentation to check the radiation dose and be sure it does not exceed the tolerance level.

Commercial film badge services can be used so that there will be an independent record of the radiation dose which any individual has received. Wherever a definite exposure to radioactive material exists, it is generally advisable to set up an appropriate routine medical program designed in accordance with the particular hazards involved. There is extensive literature for the potential user of radioactive materials dealing with laboratory design, methods of protection, methods of measurement, waste disposal, and all other aspects of safety problems. The tendency with the insurance companies has been to absorb radioactive hazards in the general rates for an industry rather than to set up special categories for such hazards.

F. H. Low, Tracerlab, classified the types of equipment needed for radioisotope work as counting equipment, sample preparation equipment, reference standards, personnel protection and survey equipment, and "Hot Lab" and storage equipment.

One of the most prolific uses of radioactivity has been in the form of "tagged" compounds. A compound is made radioactive by synthesizing it with a radioactive atom whereupon there occur innumerable possibilities for following its chemical and physical whereabouts by extremely sensitive counting techniques.

Seymour Rothchild, Tracerlab, presented a résumé of the most useful isotopes available for such work and for other purposes. The complete list is given in the catalog, "Isotopes," issued by the Oak Ridge National Laboratory. The amount of radioactivity required for such tracer experiments can be readily calculated beforehand. Many tagged compounds are now supplied by commercial sources, which may serve as useful intermediates in the synthesis of any desired compound.

An inspirational dinner lecture by George F. Manov, AEC, on "Tasks Ahead for Radioactivity in Industry" emphasized, in the light of what has already been done, the unrealized possibilities in industry for using (1) effects of radiation on matter, viz., on chemical reactions, on properties of products, sterilization, etc., (2) effects of matter on radiation illustrated by thickness gages, level indicators, instruments for chemical analysis, etc., and (3) tracers for measuring flow, abrasion, leak detection, and chemical reactions. The extensive atomic power reactor development program was sketched with the anticipation that industry will have an increasing share in the program and will also have more direct interest in reactors.

Effect on Polymers

A group of three papers dealt with the results of intense irradiation on polymers and polymer reactions. K. H. Sun, Westinghouse Research Laboratories, explained the mechanisms by which radiation is absorbed by matter, mostly by ionization and electronic excitation. With different kinds of radiation and matter the effects differ more in degree than in kind. In polymers, radiation causes breakage and rearrangement of chemical bonds and formation of free radicals so that chemical reactions are initiated. Many important physical properties may be changed by radiation induced processes such as gas liberation, degradation, polymerization, double-bond formation, cross-linking and vulcanization, vitrification, hydrogenation, etc. In other words, the phenomena are very complex and are only partially understood.

The beneficial results of the proper radiation dose on the physical properties of polyethylene have been widely publicized. Hence radiation supplies a new tool for improving the properties of plastics. The preponderance of damaging effects indicates, however, the need of a much better understanding of what goes on.[1]

Effect in Polymerization

The role of gamma radiation as an initiator for polymerization reactions was discussed by D. S. Ballantine, Brookhaven National Laboratory. Potential advantages as compared to conventional initiators such as heat, ultra-violet light, and organic and inorganic catalysts are: (1) generation of free radicals can be effected at subzero temperatures where heat-sensitive monomers may be made to react; (2) polymerizations have been successfully carried out in the solid state, and high molecular weights obtained; (3) no foreign materials are introduced, and essentially pure polymers can be obtained; (4) since gamma rays form radicals on the polymer chain, more branching and cross-linking can be expected with a consequent change in the properties of the polymer.

In general, the rate constants for gamma induced polymerization for different monomers are in the same relative order as for more conventional polymerizations. One of the unexplained features is the absence of ionic polymerization despite the ionizing character of radiation.

With solvent polymerizations, possible effects of the radiation on the solvent must be taken into account. Suitable cobalt 60 sources for this type of experimental work are available at Brookhaven National Laboratory and a number of research institutes and universities.

G. Oster, Polytechnic Institute of Brooklyn, presented current views on the mechanism of irradiated polymer reactions which take into account the detailed tracks or paths of various types of radiation in matter and deduce how these may effect localized concentrations of free radicals, their spacial distribution, and the diffusion of the free radicals in the medium. Interesting work was described on initiation by photosensitization using a strontium 90 source and anthracene crystals suspended in a solution of acrylamide containing riboflavine. This system can give a solid polymer mass which reproduces geometrically the radiation field.

Benzene tagged with carbon 14 was used by L. H. Peebles, Chemstrand Corp., to verify deductions from kinetic studies of the polymerization of vinyl acetate in benzene solution. It was proved that benzene actually copolymerized with the vinyl acetate to the extent predicted.

Use in Mold Wear Tests

A. P. Landall described a very effective radioactive tracer method for measuring the wear of steel molds used in molding phe-

[1] *Modern Plastics*, 32, 141 (1954).

nolic compositions. A sprue bushing of a conventional transfer mold was made radioactive by exposure in a nuclear reactor. Compositions molded through this bushing picked up radiation in proportion to their eroding tendency. Weeks of continuous molding would have been required to secure a wear rate result obtained by the tracer method with a few specimens. Thus it permitted systematic study of the effect of composition, especially mineral fillers, on wear and led to formulations which were greatly improved from this standpoint.

Use in Rubber, Protective Coatings, Gages

The unique possibilities afforded by carbon 14 and sulfur 35 tagged compounds for measuring molecular migration in rubber and polymers were discussed by S. D. Gehman, Goodyear Tire & Rubber Co. Methods for determining the solubility, diffusivity, and blooming of sulfur in rubber were given as illustrations. The self-diffusion of plasticizers can be readily measured, as can the migration or loss of individual plasticizers when more than one is used. Self-diffusion of polymers seems to give the same type of information as viscosity measurements. The diffusion of smaller tagged molecules into polymers should, however, provide a new, powerful method for investigating the molecular forces and segmental molecular mobility of high polymers.

The radioactive isotope of hydrogen, tritium, has been used at Battelle Institute, as was described by G. D. Calkins, to measure the penetration of water vapor into attached protective coatings. The specimens were exposed to 100% relative humidity of tritiated water for varying lengths of time. A special polishing technique enabled removal of uniform layers of coating. Each newly exposed surface was radio-assayed to determine the tritiated water content. A rather surprising result, found with a clear varnish on steel, was that the concentration, mg. per cc. of varnish, was about six times higher than the concentration of water vapor in the exposure chamber.

Two papers, one by E. T. DePass, Johnson & Johnson Co., and the other by N. S Foster, Congoleum-Nairn, Inc., discussed the most effective methods for applying beta ray thickness gages for measuring and controlling automatically web thicknesses in continuous production. Installation of manual beta gages can effect considerable improvement in gage uniformity, but the full potentialities of beta gages in this respect are realized only if they automatically control the process. By the narrowing of the spread in gage above a specified minimum, a reduction in average gage can be achieved with a considerable saving in material over less accurate gaging methods.

In the automatic control of gage there are advantages in having a beta gage mounted at each edge of the web over the use of a traversing gage. This further emphasizes the need of automatic control since it is virtually impossible for an operator to maintain uniformity by manual means with a multiple-gage installation. In a coating operation, gage control may involve measurements of the base material with one gage and the variations in this material applied against the coating variations in a subsequent gage, utilizing the differential between the two as the controlling indication. If the gages are not in close proximity, it may be necessary to include a memory circuit.

Boston Group Program on Armed Forces Elastomer Problems

The Boston Rubber Group at its fall meeting at the Somerset Hotel, Boston, Mass., on October 15, heard representatives of the Army, Navy, and Air Force explain the elastomer needs of the Armed Services. The meeting, attended by about 275 members and guests heard a panel headed by Warren Stubblebine, Connecticut Hard Rubber Co., as moderator, and comprised of Juan C. Montermoso, Quartermaster Research & Development Center, U. S. Army, Natick, Mass.; J. Horace Faull, Jr., consultant, Office of Naval Research, Washington, D. C.; and E. R. Bartholomew, Materials Laboratory, Wright Air Development Center, Wright-Patterson Air Force Base, Dayton, O., discuss the work being done by the services they represented on elastomers and the special problems on which they hoped to obtain help from the industry.

W. Fraser Malcolm, Titanium Pigment Corp., chairman of the Group, presided at the afternoon technical session and at the meeting after dinner at which Cedric Foster, noted news commentator, discussed some of the motives behind events occurring in the critical areas of the world as Europe, the Middle and the Far East.

Dr. Montermoso listed the elastomer needs of the Army as follows: (1) the need of elastomers serviceable at temperatures as low as —65° F., with and without resistance to fuels and chemicals; (2) the development of synthetic rubbers with properties approaching those of natural rubber for use in the carcass of heavy-duty truck tires; (3) the need of rubbers with thermal stability up to 600° F. with and without resistance to fuels and chemicals; (4) the prevention of rapid deterioration of rubber in outdoor exposures and in storage; (5) the application of new and improved materials to end-items to meet the ever-increasing requirements and environmental operations as well as the functional demands of modern weapons.

It was said that substantial progress has been made toward possible solutions of the above needs, and many new materials have been brought to light. In connection with end-item development, the Army is depending heavily on industry help, particularly with reference to functional designs of items and the compounding and processing "know-how" of commercial as well as experimental elastomers.

Research projects sponsored by the Army have developed some promising approaches in the development of fluorocarbon, polysulfide, silicone, and acrylic acid polymers, but it was emphasized that the Army would welcome and was most anxious to have help from the industry in order to improve elastomer materials as well as products made from these materials so that the efficiency of our military forces can be kept at the highest level.

Dr. Faull, in his talk, emphasized the types of experimental activity in elastomers being carried out by the Navy Department, which include: (1) end-item development, embracing testing, evaluation, compounding; (2) material development of a particular polymer type; (3) discovery and application of new material types; (4) fundamental research on polymer and molecular structure. He said that the greater part of attention was being directed at items (1) and (4) at the present time.

Work of interest to the Navy is being done by private enterprise programs privately supported, by external contracts with private enterprise, universities, and government agencies, by internal projects in Navy laboratories, and by independent programs in other government agencies.

Navy laboratories engaged in elastomer research and development comprise the Naval Research Laboratory, the Naval Ordnance Laboratory, the New York Naval Shipyard Materials Laboratory, the Mare Island Naval Shipyard, the Naval Air Materials Center, U. S. Naval Engineering Experiment Station, Philadelphia Naval Shipyard Industrial Test Laboratory, Portsmouth Naval Shipyard Materials Laboratory, and the Puget Sound Naval Shipyard Materials Laboratory.

Representatives of Navy agencies engaged in elastomer research were given as follows: Bureau of Ships, T. A. Werkenthin; Bureau of Aeronautics, P. R. Stone; Bureau of Ordnance, A. Lightbody; Bureau of Yards & Docks, F. B. Leitzsey; Bureau of Supplies & Accounts, T. J. Seery; and Office of Naval Research, L. Larrick.

Mention was also made of other activities of the Navy in the Navy Formulary (compound classifications for the production of various items according to Navy specifications), Navy specifications for hose, packing, etc., and a glossary of defect terms to help Navy inspectors and industry suppliers in the delivery of products under Navy contract.

Publications covering Navy Research and Development Conferences on Elastomers held in 1949 and 1952, recently declassified, also provide much information on the Navy problems and objectives in elastomers.

Mr. Bartholomew, prior to his discussion of the Wright Air Development Center rubber program, presented a brief outline of the position of the Center in the Department of the Air Force. A discussion of the more critical problems which have been encountered, or are anticipated, in aircraft and missile applications followed.

Emphasis was placed on the urgent need of improving the thermal stability of rubber compounds used for the fabrication of hose, seals, gaskets, and other rubber parts, including tires for aircraft. The heat sources causing rubber deterioration were listed as both internal, from high performance aircraft power plants, and external, from aerodynamic heating which will be encountered at high speeds.

It was pointed out that cooperation of the rubber industry will be necessary to enable new aircraft and missiles to give maximum performance and service life at least in their present state of design, since they require rubber parts such as "O" rings, seals, hose, and diaphragms for fuel, oil, and hydraulic systems, all of which must meet special service conditions.

This discussion was concluded with an outline of the more important rubber development projects now under active investigation either at Wright Air Development Center or by Air Force contractors.

Connecticut Group Outing

The ninth annual outing of the Connecticut Rubber Group was held at Derby, Conn., September 25. The day's athletic activities consisted of softball, horseshoes, golf, and egg throwing. Attending were 130 members. Arrangements for the affair were handled by James R. Boyle, David McKean, Ward Fisher, and Carl Larson.

Prizes made possible by contributions from various supplier companies were awarded winners of the various events. Many door prizes were also distributed.

oblems

n elastomer
mprise the
the Naval
York Na-
ratory, the
the Naval
aval Engi-
Philadelphia
st Labora-
ard Mate-
get Sound
oratory.
gencies en-
re given as
. Werken-
R. Stone;
body; Bu-
Leitzsey;
nts, T. J.
esearch, L.

ther activ-
Formulary
he produc-
to Navy
tions for
ary of de-
ectors and
y of prod-

Research
on Elasto-
cently de-
nformation
jectives in

discussion
nt Center
ef outline
n the De-
discussion
hich have
ipated, in
followed.
rgent need
y of rub-
ication of
ber parts,
The heat
tion were
high per-
and ex-
ng which
ds.
eration of
essary to
s to give
ce life at
ign, since
as "O"
for fuel,
of which
ons.
with an
ubber de-
ive inves-
elopment
tors.

nting

Connecti-
Derby,
athletic
rseshoes,
ng were
he affair
e, David
Larson.
ributions
es were
events.
ibuted.

ASME-SPE Hears Rubber-Plastics Talks

The use of rubber and rubber-like products in the plastics industry was the general topic for the third in a continuing series of joint meetings of the American Society of Mechanical Engineers and the Society of Plastics Engineers, assembled at the Engineering Societies Bldg., 29 W. 39th St., New York, N. Y., October 4.

D. E. Jones, American Hard Rubber Co., Butler, N. J., presented a paper on "Natural and Synthetic Rubber Products." Alex E. Javitz, special features editor of *Electrical Manufacturing*, spoke on "Silicone Rubber," and J. K. Honish, Bakelite Corp., New York, discussed "The Elastomers and Non-Rigid Plastics."

Mr. Jones, after first comparing the properties and uses of natural and synthetic rubbers, moved into the field of hard rubber applications, a subject that has been his concern for more than 30 years. The widespread industrial and commercial utility of hard rubber, he pointed out, was the result of the material's unusual resistance to abrasion and chemical action, and the facility with which it is machined.

Mr. Javitz stressed the usefulness of silicone rubber, a comparatively recent development in the rubber field, in electrical applications. Besides being a non-conductor of electrical current, silicone rubber remains unimpaired through rapid and extreme changes of temperature and also resists the degrading effects of ozone.

Mr. Honish, illustrating his talk with an exhibition of a great variety of commercial products made from non-rigid plastics such as polyethylene, fluorothene, and plasticized vinyls, noted that the geometry of the plastic usually determines its degree of flexibility and its use in the engineering of new applications.

Detroit Group Hears Abernathy

"Isocyanates and Their Reaction Products" was the subject of a talk presented to the fall meeting of the Detroit Rubber & Plastics Group, October 8, at the Detroit Leland Hotel, Detroit, Mich. H. H. Abernathy, assistant technical sales manager, rubber chemicals division, E. I. du Pont de Nemours & Co., Inc., was the speaker, and he illustrated his discussion with slides and the exhibition of rigid and cellular products made from polyurethanes. Present were 250 members and guests.

Following dinner, a talk along with movies on professional football was given by Nick Kerbawy, general manager of the Detroit Lions Football Co.

FFC Adds Two Aromatic Oils

Socony Vacuum XT-784-X and Sinclair Extract P-128, components of aromatic-type oil masterbatches X-755 and X-756, respectively, have been included on an interchangeable basis in the line of the Federal Facilities Corp., Office of Synthetic Rubber, Washington, D. C.

The masterbatches had previously been made available for consumer evaluation, and results showed that the aromatic processing oils were interchangeable with other types currently employed, such as Shell SPX 97 and Sundex 53, In the future, XT-784-X will be coded as Y, and P-128 as E.

Fort Wayne Rubber Group Hears Werkenthin

The fall meeting of the Fort Wayne Rubber & Plastics Group was held September 30 at Fort Wayne, Ind. T. A. Werkenthin, of the Bureau of Ships, presented a paper on "Some Elastomer Applications Aboard Naval Vessels."[1]

Newly elected officers for the year include: chairman, Howard C. Rapp, Belden Mfg. Co.; vice chairman, Jack L. Carlson, Paranite Wire & Cable Co.; and secretary-treasurer, Richard W. Flack, The General Tire & Rubber Co.

The next meeting of the Group is scheduled for the Van Orman Hotel, Fort Wayne, on December 2.

[1] India Rubber World, May, 1954, p. 225.

TLARGI Hears Studebaker

M. L. Studebaker, Phillips Chemical Co., addressed 285 members and guests at The Los Angeles Rubber Group, Inc., meeting, October 5, at the Hotel Statler, Los Angeles, Calif. His talk was entitled, "Chemical Forces in the Reinforcement of Rubber by Carbon Black," and presented the possibility of a carbon-sulfur-rubber linkage during vulcanization.

The exact nature of the interaction between carbon black and rubber can only be speculated upon, Mr. Studebaker said. Physical forces between the substances undoubtedly exist, but their inherently weak cohesiveness makes the possibility of a chemical bond more likely, although the evidence for this is still fragmentary.

Preliminary results of studies of the nature of surface groups on carbon black indicate the probability of the presence of quinone-type oxygen, he said, with such oxygen reacting with unsaturated groups or with the alpha methylene hydrogen groups of rubber. This action would explain the augmenting of reinforcement through heat treatment of the channel black masterbatches, he added.

Nominations for office for 1955 were presented at the TLARGI meeting and included E. C. Johnston, Caram Mfg. Co., as chairman, and C. S. Hoglund, R. D. Abbott Co., as associate chairman. W. B. Higbee, Southwestern Rubber Co., and R. N. Phelan, Atlas Sponge Rubber Co., were nominated for vice chairmanship.

Sponsoring the meeting was Ohio Rubber Co., Long Beach, Calif. Also on the speaker's rostrum was R. A. Derr, who wittily discussed "Growing Up."

To Publish Research Directory

The tenth edition of "Industrial Research Laboratories of the United States," a directory of American industries and businesses which maintain scientific research and development facilities, is scheduled for publication in mid-1955, according to the National Academy of Sciences, NRC.

The book, a non-profit undertaking, does not charge for listing in the directory, and its purchase price will be determined by the cost of publication. The Academy advises that industrial laboratories wishing inclusion in the directory should request a questionnaire from James F. Mauk, Staff Associate, National Academy of Sciences, National Research Council, 2101 Constitution Ave., N. W., Washington 25, D. C.

Lerner, McCollum Address N. Y. Rubber Group

The fall meeting of the New York Rubber Group, held at the Henry Hudson Hotel, New York, N. Y., October 22, was addressed by M. E. Lerner, editor, *Rubber Age*, on "Some Observations of the European Rubber Industry," and O. H. McCollum, rubber chemicals division, E. I. du Pont de Nemours & Co., Inc., who reported on "The Processing Characteristics of Hypalon Chlorosulfonated Polyethylene."

Mr. Lerner's recent study of the European rubber industry included visits to plants in England, France, Italy, The Netherlands, and West Germany. Facilities in England and Italy, especially, he asserted, were on a par with those in the United States, both in modernity of production equipment and size of operations. Huge sums, too, were being spent in research, he said, although the emphasis was on natural rubber development, particularly in England and France, which have huge natural rubber holdings.

He reported that one large plant in northern Italy had 1,000 of its 10,000 employes devoted to research. The development of rubber-asphalt roads was being taken more seriously in Europe than here, he said at another point. His talk was illustrated extensively with slides.

Mr. McCollum's address was given over to a comparison of the processing characteristics of du Pont's Hypalon with those of neoprene and GR-S stocks. Although no new facts were reported, the talk served to delineate Hypalon's proper position beside other rubber materials. Its relatively high cost still limits the extent of its use in rubber compounding.

The technical session of the meeting was followed by a cocktail hour and dinner. Harry Lorayne, a memory expert, composed the evening's entertainment program, and his prodigious feats included the memorization and recital of the names of the more than 250 members and guests present.

McLeod Discusses Alfin Rubber

The Ontario Rubber Section, C.I.C., meeting, October 5, at Toronto, Ont., Canada, was addressed by L. A. McLeod, Polymer Corp., Ltd., Sarnia, Ont., on the development of Alfin rubber. It was the Alfin catalyst which paved the way for the production of these extremely high molecular weight linear polymers now in pilot-plant production, Dr. McLeod said.

Copolymerization with sufficient styrene and masterbatching with oil has produced a processible material whose tensile, tear, and hysteresis are comparable to standard oil masterbatches, he stated. Its modulus is much lower, and its flex life higher than those of standard polymers, suggesting the possibility of certain specialized applications, he added.

Address Buffalo Rubber Group

Robert Havenhill, St. Joseph Lead Co., and Harry K. Fisher, Natural Rubber Bureau, were the principal speakers at the October 5 meeting of the Buffalo Rubber Group. Mr. Havenhill's subject for the technical session in the afternoon was "The Electrostatic Contact Potentials of Rein-

(Continued on page 260)

NEWS of the MONTH

Washington Report and National News Summary

Although detailed information on the progress of the negotiations between the Rubber Facilities Disposal Commission and prospective buyers of the synthetic rubber plants was lacking in late October, it is understood that the meetings of the buyers and the seller have resulted in some better chances of their getting together on mutually satisfactory prices.

The Disposal Commission did distribute to prospective purchasers a proposed contract form, spelling out in detail just how the plants will pass from government to private ownership, if Congress approves the Commission's recommendations.

Somewhat more information on the progress of negotiations may be forthcoming, however, when Holman D. Pettibone, chairman of the Commission, addresses the annual meeting of the Rubber Manufacturers Association, Inc., in New York, N. Y., November 18. Representatives of the firms bidding on the synthetic plants and members of Congress concerned with rubber legislation, as well as other members of the Commission, will also be present at this RMA meeting.

Adjustments in the government's synthetic rubber production and inventory resulting from the mid-summer strikes in two of the major rubber companies have been completed.

Well-situated companies in the rubber industry should enjoy a satisfactory year in 1955, according to a recent report from Standard & Poor's Corp., New York.

A new working-conditions contract was signed between The B. F. Goodrich Co. and the United Rubber Workers, CIO, on October 19, for a period of 2½ years.

Washington Report by Arthur J. Kraft

Disposal Commission Distributes Sales Contract; Pettibone to Address RMA Annual Meeting in November

Negotiations between the government and prospective buyers of its synthetic rubber facilities continued in October at an accelerated pace, but no contract signings or other concrete developments were reported as the month-end hove into view.

Sales Contract Distributed

The Disposal Commission, however, took one essential step in drawing up legal papers to present for each buyer's signature when the parties are ready to close sales. The Commission last month mailed to each of the 34 firms which have bids in on the plants a tentative uniform draft of contract for sale of the plants and asked for comment and suggestions on the contract provisions.

The contract follows the conditions of sale laid down by Congress in the disposal law last year and spelled out in the Commission's solicitation of bids and subsequent amendments to its rules.

The proposed contract form—a 22-page document—was intended primarily for the eyes of corporation lawyers. Its 26 sections cover, among others, such matters as method of payment, liability for damage to the facilities, lawsuits or obligations stemming from patent infringements or royalties, etc., a national security clause, and provisions covering the procedure of transferring ownership to the purchaser.

In all, the contract spells out in detail the legal procedure by which the properties will pass from government to private ownership, assuming Congress throws no road-block in the path of disposal after the Commission makes its recommendations to that body next January 27.

The deadline for winding up negotiations is December 27, and it seems likely that few, if any, contract signings will take place much before then. Most observers anticipate contract signings will take place with a closing rush. It will be recalled that the original bids were submitted to the Commission hard-on the May 27 deadline, even though bidders had all of the previous six months in which to make their offers.

Little comment concerning the progress of negotiations had emanated from the Commission, or anyone else, thus far. The last word, and that came some weeks ago, was that an unspecified number of bidders were considering boosting their original offers by coming in with new higher priced bids, while others were considering transferring their buying interests to plants on which they had not originally bid.

Disposal Commissioners, Congressmen, and Bidders at RMA Meeting

A line on how the negotiations are moving, however, should come November 18 from the man best equipped to give an authoritative judgment. On that day Holman D. Pettibone, chairman of the Commission, is scheduled to deliver the main address to the annual RMA meeting in New York.

Underlining the expected significance of his remarks is the fact that the RMA will break with precedent by including in the guest list a number of persons who normally would not be present at a rubber industry function.

With an enthusiastic nod from the Commission, the RMA has invited to the meeting representatives of each of the 35 firms (including the one firm negotiating for purchase of the facilities which submitted a bid for tank cars only), along with a group from Congress. The latter includes Chairman Homer E. Capehart (Indiana) of the Senate Banking & Currency Committee; the Committee's ranking Democrat, Senator J. W. Fulbright (Arkansas); and its staff director, Ray S. Donaldson. Also invited were Chairman Dewey Short (Missouri), of the House Armed Services Committee; the committee's ranking Democrat, Representative Carl Vinson; and its general counsel, John R. Blandford.

The Banking & Currency Committee in the Senate and the Armed Services Committee in the House have jurisdiction over the rubber disposal program, having considered and reported the bills which ultimately became the Rubber Disposal Act of 1953, under which negotiations are now being carried on.

Those two committees again will have first crack at whatever recommendations are submitted by the Disposal Commission next January. The disposal program—that is, the sales contracts—must clear both committees before reaching the stage of final Congressional action.

The House committee is prepared to depart from precedent in the procedure for handling the rubber disposal question next year. In the 83rd Congress, as in other years when the House was organized by a Republican majority, rubber legislation was handled by an Armed Services subcommittee in the first instance, with subsequent proforma consideration by the full committee. That subcommittee was headed by the late Paul R. Shafer (Republican, of Michigan).

Chairman Short already has made known that, in the event the Republicans hold control of the House next January, the disposal issue will be handled directly by the full committee, rather than a subcomittee. The reason is that no member of the subcommittee is equipped with sufficient background on rubber to fill Shafer's shoes. In Democratic controlled Congresses, the full committee handled rubber affairs and will do so again should Mr. Vinson's party organize the House in January.

Summer Strikes Cause Synthetic Sales and Inventory Adjustments

The government's synthetic rubber business was back on even keel last month after some relatively minor disturbances resulting from strikes against two major companies in July and August.

The strikes at Goodyear and Firestone

brought a shutdown of two government plants, both latex producers, operated by these firms at Akron. Aside from meeting difficulties in filling orders for latex, the government was forced to defer deliveries to the struck firms of other types of GR-S as well.

The strike impact showed up chiefly in the August sales figure of 36,214 long tons, well off the 44,000 tons anticipated before the strikes occurred. The catching-up with the deferred demand showed up in September, when sales soared to 51,260 tons, including some 6,500 tons carried over from July and August delivery schedules. A breakdown of September sales shows LTP GR-S, 37,151 tons; oil masterbatch, 17,-485 tons; black masterbatch, 5,386 tons; oil-black masterbatch, 2,846 tons; and GR-S latices, 3,681 tons. Butyl sales totaled 4,815 tons.

About 1,000 tons from the September delivery schedule were carried over to October—a normal month-to-month carry-over.

Unfilled orders for latex had tapered off somewhat as September neared an end. The strikes had cut August deliveries of latex to 1,849 tons, but they were back up to 3,681 tons in September. The Federal Facilities Corp., which operates the government plants, scheduled latex output at a relatively high 4,885 tons for October, enough to wipe out the backlog as well as meet current orders.

FFC's customers, many of whom had stocked up heavily on GR-S this summer when Communist advances in Indo-China threatened to spread to other crude rubber producing countries, are now making plans to readjust their inventories.

The agency announced last month that GR-S sales in January are likely to fall 7% below the expected December level as a "result of consumer inventory adjustments." The estimate was based on 90-day advance orders placed by larger consumers up to October 10.

FFC gave as its January sales estimate 43,000 tons. Sales for December were put at 46,500 tons and for November at 43,000 tons. This estimate follows an earlier one placing October sales at 46,000 tons.

FFC production schedules call for an output of 44,000 tons in January; 44,300 tons in December; 40,400 tons in November; and 41,800 tons in October. The October estimate represents a 600-ton increase over the level anticipated in FFC's mid-September report, with most of the increase involving latex. The November and December figures, however, represent cutbacks of 100 and 2,800 tons, respectively, from previously planned levels.

FFC did some heavy dipping into its own inventory to come up with its sizable September sales total. The agency trimmed its GR-S inventory from 82,800 tons on August 31 to 70,400 tons a month later. That is a sharp reversal in form when compared with the steady mounting of government rubber stocks through last winter and spring. Sales of GR-I (Butyl), not included in the above figures, amounted to 4,815 tons in September.

The October production schedule, as tentatively set midway in the month, is for a total GR-S output of 41,800 tons, including the oil content of oil-extended rubbers, but excluding carbon black used in black masterbatches. That basis is the same one on which all of the above figures are reported. The schedule calls for 30,000 tons of GR-S cold rubber (LTP); 13,-000 tons of oil masterbatch; 3,150 of oil-black masterbatch; 2,100 tons of black masterbatch; 4,885 tons of GR-S latex; and 5,000 tons of GR-I. The black and oil-black masterbatch totals include carbon black contained in their formulation.

FFC came up last month with some revised estimates of calendar year 1954, GR-S output and sales. Again including oil content, the production total is now estimated at 470,000 tons (compared with the mid-September forecast of 467,000 tons); while sales are put at 488,000 tons (a drop of 1,000 tons from the previous calculation.)

National News

Standard & Poor's Industry Analysis

In its publication "Industry Surveys—Tires and Rubber," of October 7, Standard & Poor's Corp. states that reflecting lower combined original equipment and replacement tire demand, competitive pressure on prices, and smaller military takings of tires and special items, sales of nine reporting companies showed an 11% decline for the first half of the 1954 fiscal year.

Margins were under pressure from competitive adjustments, higher labor costs, heavier depreciation provisions, and lower volume. Taxable earnings were off 26%, but with sharply reduced tax rates in many instances, plus the reduction or elimination of special reserves, composite net income fell only 1.8%.

The contraction in 1954 pretax earnings is expected to be more severe than that in sales. Final earnings of a few companies, because of the removal of the excess profits tax, will score satisfactory gains, it was said. While earnings for some other companies will be lower, they should still be favorable. The poorest showings will be made by some of the smaller factors in the industry.

Tentative projections of automobile production suggest little change in original equipment tire business in 1955, and replacement tire business outlook is brightened by the record number of cars and trucks in use and the growing emphasis on tubeless tires. A further downtrend in sales of special military items and of some industrial products is anticipated, but further gains in foamed rubber and chemicals may prove an offset.

Labor costs have increased, and it is not certain that the competitive climate will permit price advances. The tire inventory situation is improved, however, and is expected to remain that way in order to avoid extensive price cutting as tubeless tires take over a growing portion of the market.

In commenting on the synthetic rubber plant disposal situation, Standard & Poor's pointed out that many conflicting factors make it impossible to predict if the disposal program will be accomplished at this time.

Balancing presently known factors, indications are that the well-situated companies in the rubber industry should enjoy another satisfactory year in 1955, it was concluded.

New Goodrich Contract Signed; Akron Local Approves General Tire Wage Increase

Negotiators from the Goodrich company and the United Rubber Workers went back to the bargaining table on September 20, only a couple of weeks after leaving it on August 29 by virtue of agreement on a wage increase. The new negotiations were concerned with a new working-conditions contract for Goodrich workers to replace the previous agreement expiring on October 15.

In early October the local URWA union at the Akron plant of The General Tire & Rubber Co. finally accepted, with some further adjustments, the 6½¢-an-hour wage increase agreement worked previously.

The Goodrich Contract

The Goodrich working-conditions contract signed on October 19, subject to approval of the local unions, will be effective through April 15, 1957, with a 60-day reopening clause on wages. Extension of the previous agreement on a more or less day-to-day basis took place after the end of the old contract on October 15.

Some of the issues discussed were the conditions under which outside conractors could be hired by the company, vacation periods and pay, and incentive work standards. Although details on the final contract are not available, it is understood that the extra paid holiday asked by the union was not obtained, and the one-year contract also desired by the union finally became a 2½-year contract.

The Goodrich unions took a strike vote in early October in connection with the negotiations, but no strike was actually called.

General Wage Contract Settled

After several additional bargaining sessions the local Akron URWA union of General Tire approved on October 11 the 6½¢-an-hour wage increase agreed to earlier between the international URWA union and the company. Other local unions of General Tire had approved the wage increase, but the local Akron union required some further negotiation to arrange for the use of ½¢-an-hour of the increase to adjust intra-plant rates, it was reported.

Air Force Orders Tubeless Tire

The first contract for tubeless airplane tires for the U. S. Air Force has been awarded to Goodyear Tire & Rubber Co., according to E. H. Eickmann, manager of the firm's aviation products division, Akron, O. The 24 x 7.7 tires will be designed for the nose wheel of the F-105 fighter plane made by Republic Aviation Corp.

The advantages of the tubeless tire for aircraft use, Mr. Eickmann said, are lighter weight, decreased running temperature, elimination of inner-tube failures, and greater facility of installation.

Other Industry News

General Tire Dedicates $6 Million Ashtabula Vinyl Resin Plant

The General Tire & Rubber Co.'s new $6,000,000 polyvinyl chloride resin plant in Ashtabula, O., was dedicated on October 21, by Gov. Frank J. Lausche of Ohio before more than 150 executives of neighboring industries, leading Ashtabula citizens, representatives of the press, and officers and executives of the company.

With production of the company's "Vygen" resin under way at the plant, General Tire ranks as one of the world's largest integrated manufacturers of plastic film and sheeting. Last April 30, Bolta Corp., Lawrence, Mass., and Textileather Corp., Toledo, O., were merged with General Tire.

The new plant's 14 major operating buildings and eight auxiliary buildings, shown in the accompanying illustration, are geared for an annual production of 25 million pounds of polyvinyl chloride resin. The adjoining plant of the Electro-Metallurgical Division of Union Carbide & Carbon Corp. will supply the General Tire plant with acetylene gas. Another nearby plant of the Hooker-Detrex Co. will supply hydrogen chloride. From these two materials is produced the vinyl chloride monomer, which, after purification, is polymerized in water in any or all of ten 3,500-gallon reactors. The polymer slurry is partially dewatered in centrifuges and, after drying in a rotary dryer, is packed in bags for delivery to the Bolta, Textileather, Jeannette, Pa., Wabash and Marion, Ind., plants for fabrication into finished products, or sold to other fabricators for the manufacture of vinyl plastic products.

Contractor for the Ashtabula vinyl resin plant was United Engineers & Constructors, Inc., of Philadelphia. Process equipment was designed by Scientific Design Co. of New York. General Tire's central engineering department coordinated the project.

Factory manager is James A. Pollack. A. L. Antonio, of Aerojet-General Corp., a subsidiary of General Tire, is on special assignment to head up the company's chemical operations during the opening of the Ashtabula plant.

Aerial View of New General Tire Polyvinyl Resin Plant at Ashtabula; Monomer Production and Purification in Extreme Right Background with Polymerization Building (Three Slurry Tanks in Front) Adjoining; Buildings in Center Include Resin Drying, Packaging, and Warehousing

At a dinner at the Hotel Ashtabula on the evening of October 21, Dr. Antonio acted as toastmaster and paid tribute to all those both within and without the company who had a part in the design, construction, and operation of the new vinyl resin plant. He paid special tribute to the officials and citizens of Ashtabula for their help and cooperation, and in return brief talks were made by the City Manager and the head of the local Chamber of Commerce and others.

M. G. O'Neil, youngest son and executive assistant to the company president William O'Neil, spoke on his belief in the future of this country being intimately bound to the future of the chemical industry. He mentioned as evidence of his company's support of this belief the fact that General Tire had signed ten-year contracts with Electro-Metallurgical and with Hooker-Detrex for the basic raw materials for the Ashtabula vinyl resin plant. He also emphasized the integration of the Ashtabula resin plant operations with those of the Bolta and Textileather as well as other plants of the General Tire chain.

Goodrich Announces $100 Million Expansion Program; Emphasis on Tubeless Tire Facilities

A five-year program designed to increase annual sales and involving an expected outlay of at least $100 million for new and improved facilities was announced at a press conference in New York, N. Y., October 26, by Joseph A. Hoban, vice president of the tire and equipment division of The B. F. Goodrich Co., Akron, O. He stated that a large share of this expansion would be devoted to tubeless tire production and distribution facilities. Capital expansion in 1954, again mostly for tubeless tire facilities, amounted to $30 million.

Goodrich, which was the first to put tubeless tires on the market in 1948, has manufactured and sold about 3½ million of them, more than the combined total of all other makes, it was said.

Hoban, who was in New York to introduce the company's new original equipment passenger-car tubeless tire, the "Safetyliner," and to attend the American Trucking Association convention, said the tubeless tires' light weight and inherent protection against blowouts have been responsible for their acceptance by automobile manufacturers as original equipment on 1955 cars. He emphasized that "The Tubeless Tire Era" is here and that the coincidence of more and more super highways made the market for tubeless tires very good since these tires run cooler and do not blowout, very desirable safety features when tires are subjected to long periods of high speed driving on these highways. Carcass bruise damage with tubeless tires results in slow leaks rather than blowouts because of the inner liner adhered to the inside of the tire.

Also unveiled were heavy-duty tubeless tires for trucks, a tubeless tire for farm tractors, a nylon tubeless tire for jet fighter planes, a nylon tubeless tire for heavy bombers, and a wide-based tubless tire for heavy earthmoving and construction equipment.

Hoban said that the inner tube is as obsolete as the handcrank and the running board on the modern automobile. It will take three years to replace the inner tubes on the majority of America's automobiles and in five years, by 1960, the inner tube will be no more.

In 1960 there will be 55 million passenger cars registered in this country, compared with 48 million today. The passenger-car tire replacement market, by this time almost exclusively tubeless tires, will be 66 million units, compared to 48 million today, Hoban added. Goodrich expects that the 30% of its replacement tire business now being filled with tubeless tires will increase to 50% in 1955.

Install 25-Ton Water Chillers

Four Servel DUT 25-ton water chillers have been installed at Quaker Rubber Corp., division of H. K. Porter Co., Inc., Philadelphia, Pa., to provide the cold water needed for rubber compounding from May to October, when water from the nearby river cannot be used. Waste steam is employed as fuel for the chillers, the company reveals.

Conklin Business Manager of *Plastics Technology*

James L. Conklin

James L. Conklin has been appointed business manager of *Plastics Technology*, Bill Brothers Publishing Corp.'s new journal, which will make its first appearance early in 1955. A Navy pharmacist's mate in both the Pacific and European theatres of operation during World War II, Mr. Conklin subsequently was graduated from Kenyon College, where he majored in biology and chemistry.

He served for several years as new product sales promotion manager for The William S. Merrell Co., drug manufacturer. Later he joined *Chemical and Engineering News* and rose to the position of district manager.

He was born in Englewood, N. J., 31 years ago. A resident of Haworth, N. J., Mr. Conklin is active in local politics, the Industrial Advertisers Association, the T. F. Club, and The Dotted Line Club. His favorite sports include golf and fishing.

He is married and the father of a girl and a boy.

In his capacity as business manager of *Plastics Technology*, Jim Conklin will devote most of his time to the sales end of the business.

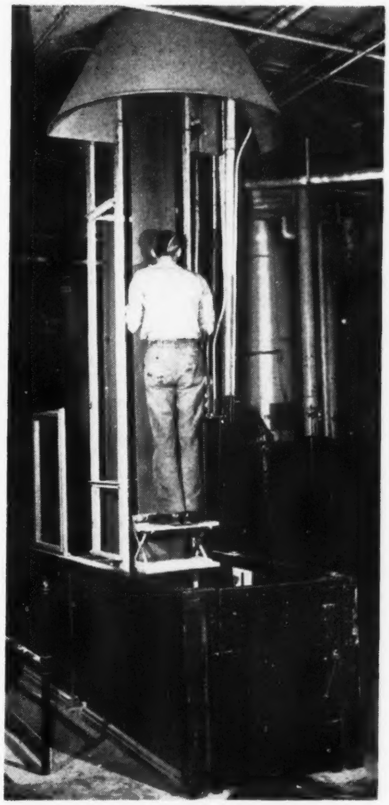
California Unit for Reichhold

Completion of a new polyester production unit at its Azusa, Calif., plant, has been announced by Reichhold Chemicals, Inc. With an estimated annual capacity of 10,000,000 pounds, the additional facilities are primarily intended to supply polyester resins to West Coast reinforced plastics producers.

Goodrich Opens Massachusetts Warehouse

A new warehouse, capable of storing 50,000 tires of all types, as well as conveyor and transmission belting, hose, and other items, has been put into operation by The B. F. Goodrich Co. at West Springfield, Mass. The one-story brick and steel building, occupying 70,000 square feet of floor space, will supply the New England and eastern New York territories.

Vertical Conveyors at Quaker Oats



"Man-Lift" Belt in Operation at Quaker Oats Co., Akron

Predecessor of passenger conveyor belts now coming into popular use is one that has been in operation for more than 50 years at Quaker Oats Co., Akron, O., according to The B. F. Goodrich Co., manufacturer of the fabric-reinforced rubber belting upon which the system is based.

Circular openings 30 inches in diameter in the floors and ceilings of the 10-story building allow the passage of single passengers riding wooden platforms both up and down. The belt is a continuous loop passing around pulleys at each end of the system. Quaker Oats has 12 such conveyors in the plant, Goodrich reports, with great annual savings in man-hours.

Names Adhesives Distributor

Canadian Bronze Powder Works, Ltd., Montreal, P.Q., Canada, has been appointed Canadian distributor for the industrial adhesives line of Rubber & Asbestos Corp., Bloomfield, N. J. The line includes a wide range of rubber-based and synthetic resin-based adhesives and compounds.

Dunlop Scores a First

The first vehicle through the western toll gate of the 58-mile Buffalo-Rochester stretch of the New York Thruway was a 10-wheel semi-trailer operated by Dunlop Tire & Rubber Corp., Buffalo, N. Y., it has been reported.

Hale & Kullgren Reports New Developments

Aetna-Standard Engineering Co., Warren, O., has $200,000 worth of equipment for repair and rebuilding of Banbury mixers, Hale & Kullgren, Inc., Akron, O., subsidiary of the company, reveals. Parts can be constructed to match the originals, or the customer can receive a totally rebuilt body in exchange for a depreciated one if a production schedule makes immediate service necessary.

Hale & Kullgren also reports that it is building a new process laboratory for developmental work in rubber and plastics extrusion. The laboratory will contain such recently designed machines as nylon hot stretch units, automatic mill and rotational casting machines, and a complete plastic pipe pilot line. The laboratory has facilities for extruding all kinds of rubber products and different plastics. Expected to be served are the steel, plastics, rubber and tire industries.

Other new developments reported by Hale & Kullgren include the following: a machine for rotational casting of plastisols which will produce such items as toys, balls, and paint rollers and which will be installed by Sun Rubber Co., which holds some of the patents on the unit: a new type of extruder that provides uniform and automatic heating or cooling through the barrel; and a four-ton heavy-duty machine that cubes nylon, teflon, polyvinyl chloride, and polyethylene at the rate of 3,000 pounds an hour with a minimum of noise.

Augment Interstate Welding

Interstate Welding Service, now a division of Skinner Engine Co., 337 W. 12th St., Erie, Pa., has announced the enlargement of its facilities for Banbury mixer repairing. Services offered by the firm include inspection interchanging of bodies, or complete rebuilding.

President of the parent company is J. Skinner. G. A. MacLean heads Interstate Welding.

Mobay Building W. Va. Isocyanate Plant

A plant said to be the first full-scale production unit in the United States devoted to the manufacture of isocyanate chemicals will be built by Mobay Chemical Co. at New Martinsville, W. Va. According to the company, isocyanates are used in combination with polyester resins to produce flexible and rigid foamed plastics, wire coatings, paints, synthetic rubber formulations, and adhesives.

Mobay reveals that it will produce no finished products, but will, instead, turn out the basic raw materials for the isocyanate foam, including isocyanate and polyester resins, activators, modifiers, and catalysts. Licenses will be granted to interested firms, and machinery and production methods will be furnished them.[1]

The company was formed recently as a joint venture of Monsanto Chemical Co., St. Louis, Mo., and Farbenfabriken Bayer A.G., Germany. Bayer, originator of the foam process, has been producing the new isocyanates for two years. Monsanto has a small-scale isocyanate plant already in operation at Anniston, Ala.

[1] RUBBER WORLD, Oct., 1954, p. 97.

International Chemical Industry Development CCDA Theme

The theme of the meeting of the Commercial Chemical Development Association held in Bedford, Pa., October 7 and 8, was postwar chemical development, with particular emphasis on international trends.

M. F. Mitchell, Shell Petroleum, Ltd., declared that American exports cannot be built by random sales in foreign markets. To trade abroad successfully, the American producer must have an understanding of the problems of foreign producers, a recognition of the different methods of approach of foreign businessmen, and a realization that international trade must operate as nearly as possible freely and easily.

American producers have little to fear from low-cost foreign chemical competition since many American products are not being produced abroad and have no acceptable foreign substitute, and products can be made in large volume at low cost in the United States because of our well-engineered and carefully planned plants. Also, more emphasis on development and commercial research exists in the United States. Since 1938, European chemical production has increased about 80%, as compared with 200% in this country. Since 1950, however, production in Europe has increased about 30%, compared with 20% for the United States.

Vigorous growth for most chemical products, including plastics, synthetic detergents, and polyester and vinyl fibers, was predicted. Consumption of plastics by 1960 is expected to increase 140% over 1950 output in countries outside the United States, with thermoplastics accounting for an increasing share. Production of polyester fibers is expected to reach a rate of 90 million pounds annually outside the United States, not including the 10 million pounds' capacity under construction in Canada. Vinyl fiber capacity by 1956-7 should reach some 95 million pounds, Mitchell further declared.

There is great need abroad of American services and skills, such as plant design, engineering, production know-how, management practices, patent rights, and financing, according to Martin de Simo and B. J. Gaffney, of Chemical Construction Co. It was pointed out, however, that U. S. companies are not alone in offering some of these facilities and services, and competition from foreign companies is steadily mounting.

Finding worthwhile foreign technical processes and developing them in the United States is a complicated procedure, Harvey J. Taufen, Hercules Powder Co., stated. He said that designated representatives of American firms should make a specialty of the field, and he urged that they utilize all available sources of information on foreign technical developments. Personal knowledge of foreign technical and industrial personnel is highly important, this speaker added, and worth a great deal of time and effort.

Opportunities for American firms to have research work performed abroad were discussed by Frank C. Croxton and Bertram D. Thomas, of Battelle Memorial Institute. American firms can support the work of various professors in European universities, sponsor research projects of specific interest in European institutes, and license already completed research for commercial development in the United States. Battelle recently established two laboratories abroad, one in Frankfurt, Germany, and the other in Geneva, Switzerland.

Dinsmore Talks on Selling Chemicals

As one of the speakers at the Third Chemical Sales Clinic of the Salesmen's Association of the American Chemical Industry held at the Hotel Commodore, New York, N. Y., October 11, R. P. Dinsmore, vice president, Goodyear Tire & Rubber Co., discussed "Using the Tools of Selling."

Dr. Dinsmore pointed out that a prospective buyer is always interested in looking at the thing he is going to buy; therefore, the product or a sample of the product is one of the first things to show the customer. If the nature of the product is such that this showing cannot be done, pictures and clear, concise descriptive material must be substituted, and it is here that the technical brochure fits into the development of the theme of selling.

Equipped with a well-organized brochure, the salesman must employ a certain amount of psychology in its use. It was suggested that the salesman leaf through the brochure with the customer in order to determine the major items of interest, but in no case prolong this process until it bores or irritates the customer.

The commercial background of the product being sold is a valuable sales tool, and information on available production capacity, trend of consumption, etc., leads to a discussion of the customer's requirements and furnishes a basis for the discussion of price trends, costs, and possible interest by the prospect in other materials which may be considered as substitutes or replacements for the product being sold.

One of the most expensive and the most useful tools of selling is the sales laboratory. Here may be developed much of the information required for the technical brochure, and to the laboratory may be brought specific customer applications and problems that can build an important degree of customer good will, if properly handled.

Another of the tools of selling of considerable importance is the salesman's knowledge of the business in which he is engaged, but it was said it is best to stick to the facts and not merely rely on trade rumors and gossip.

Finally, personal characteristics, appearance, and ability of the salesman to express himself accurately and concisely are important selling tools. It is essential that the salesman remember he is in business to sell his products not once, but continuously, and neither his selling tools nor his power of persuasion should be misused to persuade the customer to buy something which he should not buy or is not ready to buy, Dr. Dinsmore said in conclusion.

Quaker Rubber Adds Warehouse

A 16,000-square foot warehouse, constructed of prefabricated structural steel and cinder block, has been built by Quaker Rubber Corp., division of H. K. Porter Co., Inc., Philadelphia, Pa., doubling the firm's warehouse facilities. The new building will also include a hose processing department and more shipping equipment.

Businessmen in Cold War

The role of American businessmen in the continuing cold war was outlined by George R. Vila, assistant general manager of Naugatuck Chemical division of United States Rubber Co., Naugatuck, Conn., in a talk before the Painesville, O., Chamber of Commerce, October 11.

"Business has its special tasks cut out for it in the battle," he said. "It must do more than point to its material progress as proof that our way is best. It must do more than explain that capitalism is the economic expression of real democracy. It must show that the American way adds to the dignity of man."

Today, Vila said, industry realizes the need of better human relations and responsible unions are aware of management's problems. Management and labor today have too much in common to be characterized as necessarily opposed, as was the case in years gone by.

Packing Selector Offered

A device for rapid selection of an appropriate industrial packing has been developed by New York Belting & Packing Co., Passaic, N. J. Called Simplified Packing Selector, it is a six-inch rotating cardboard disk that gives packing styles and pressure and temperature readings for gaskets, valve stems, and centrifugal and reciprocating pump applications.

The material being handled, water, steam, brine, ammonia, etc., is printed alongside a window in a second and smaller disk mounted on the larger one. The correct packing shows up in a window alongside the material being handled as the smaller disk is rotated in accordance with the conditions of the application. The reverse side of the "wheel" gives the sizes in which the recommended packing is available.

This selector is free on request.

To Build Extra-Long Conveyor

A Potash Co. of America mine at Carlsbad, N. Mex., will shortly be equipped with one of the longest conveyor systems in the United States, according to Hewitt-Robins, Inc., Stamford, Conn., contracted designer and builder of the system. To be completed in late 1955, the linked rubber belting will extend a nominal length of 7¼ miles and an overall length of almost 15 miles and will operate at depths of up to 1,000 feet.

Buys Interest in Heintz

The Akron Standard Mold Co., Akron, O., has acquired a financial interest in The James C. Heintz Co., Cleveland, O., manufacturer of retreading equipment and aluminum new tire mold inserts. Heintz will continue to be operated without change of management or personnel.

Hobbs Names Sales Agent

Hobbs Mfg. Co., Worcester, Mass., has appointed Parrott & Ballentine its exclusive sales representative in 11 southern states to distribute the firm's Controlled Tension "Alquist" Winder and Jacques hand shears.

Thiokol Chemical Corp., Trenton, N. J., has initiated the practice of presenting awards to employes with more than 10 years of service to the company. Andrew Fossum *(right)*, the firm's first 25-year-man, received the initial award, from J. W. Crosby, president *(left)*, during recent ceremonies, at which 27 others were also honored. J. C. Patrick *(center)* was the recipient of a special gift to commemorate his discovery of Thiokol synthetic rubber, the company's chief product.

Reproduce Plaster Molds with Thiokol

Rubber core box patterns suitable for heavy production of precise investment plaster molds are now being made from Thiokol liquid polymer, according to the manufacturer of the polymer, Thiokol Chemical Corp., Trenton, N. J. The Thiokol mixture can be poured at room temperature and sets without heat to a resilient, low-shrinkage, completely curable rubber, the company says.

Besides investment plaster molds, the cold-setting polymer is said to be applicable to model making and to various operational procedures connected with the production of metal tools, dies, and fixtures. Finished items such as printing rollers, relief maps, poured-in-place gaskets, and electrical embedments can also be made, it is reported.

According to the company, a typical formulation for these applications involves the compounding of Thiokol liquid polymer, stearic acid, zinc sulfide or carbon black, a sulfur dispersion, and accelerator. After a 24-hour cure, the mixture exhibits a Shore hardness of 40-45, a tensile strength of 350-400 psi., and an elongation of 350-450%. Maximum working time is said to be five hours.

Porter Named O-Ring Distributor

Robert B. Porter Co., 1125 Goodrich Blvd., Los Angeles 22, has become California factory representative and sales jobber for Minnesota Rubber & Gasket Co.'s custom molded rubber products, including O-ring seals for hydraulic, air, and gas devices.

New Dow Chicago Sales Office

The Dow Chemical Co., Midland, Mich., has opened a new sales office at 3030 S. Ashland Ave., Chicago, Ill., to handle the distribution of its products for the states of Minnesota, Wisconsin, Iowa, Illinois, Indiana, and Michigan. L. R. Sulik will be in charge.

Du Pont Completing $12,000,000 Lab Expansion

Ten new industrial research and service laboratories have recently been completed or are now being built by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., in a program designed to insure stabilized production in the future and to maintain a high level of employment.

The new units, to cost more than $12,000,000, include a $2,550,000 addition to the company's Experimental Station near Wilmington, which will consist of two laboratories, one for the electrochemicals department, the other to be operated by the pigments department. The latter also will be augmented by a smaller laboratory now nearing completion at Newark, N. J., for the development of new colors for paint, ink, paper, and plastics.

The firm's film department will be expanded by two laboratories, one costing $1,275,000 and intended for fundamental research in packaging and industrial films, the other costing $1,000,000 and having as its purpose the expansion of sales development and technical service for du Pont's films and sponges. Both are in the Wilmington area and will be ready for occupancy by the end of 1955, according to the company.

Largest of the projects is a $5,000,000 textile research laboratory which opened this summer at Chestnut Run, Del. Intended as an expanded customer service, the laboratory will be devoted to the study of fiber and fabric characterization, construction and performance of fabrics, and fibers finishing and dyeing methods.

A new laboratory for conducting chemical and engineering research on Dacron yarn and staple has already been added to the facilities of the textile fibers department at Kinston, N. C., and still another is under construction at Newport, Del., which has as its objective the general development of synthetic fibers for industrial uses.

Finally, du Pont reports, a $3,000,000 laboratory for the polychemicals department at Chestnut Run is partially occupied and due for completion within several months. This is intended to provide additional sales and engineering services to customers in the plastics industry and includes study courses on the use of plastics as new engineering materials.

Dallas Office for Wellington Sears

Wellington Sears Co., 65 Worth St., New York 13, N. Y., has opened a new office in Dallas, Tex., at the same time closing its New Orleans office, it has been reported.

Hugh H. Tate is in charge of sales activities at the new office and is assisted by Larry Carr.

Goodyear Buys Plantation in Brazil

An 11,000-acre jungle area at the mouth of the Amazon River has been purchased by The Goodyear Tire & Rubber Co., Akron, O. Sixty miles east of Belem, Brazil, the land will be converted into a rubber plantation, the firm's first such venture in almost 20 years.

The Brazilian Government, attempting to establish its own rubber growing industry, will cooperate in the enterprise. The new plantation is eventually expected to become a supplier for Goodyear's Sao Paulo tire plant.

Du Pont Shows Mylar Exhibit

An exhibit of Mylar polyester film, product of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., was previewed November 3-5 at the Hotel Roosevelt, New York, N. Y., before being taken on a nationwide tour which will include Chicago, November 16-18, and Cleveland, November 30-December 1.

On display were the industrial and commercial applications of the film, as well as illustrations of its physical, electrical, thermal, and chemical properties, which, according to the company, allow for new design changes and product improvement.

Quaker Pioneer Buys Lawn Hose Facilities

Quaker Pioneer Rubber Mills, Pittsburg, Calif., division of H. K. Porter Co., Inc., has announced the purchase of the lawn hose division of Extruders, Inc., Hawthorne, Calif. The latter will continue to manufacture polyethylene film.

New Midwest Reclaiming Plant Toured

A tour of its recently completed plant at Paramount, Calif., was conducted by Midwest Rubber Reclaiming Co., East St. Louis, Ill. Constructed at a cost of $2,500,000, the new facilities are expected to produce 25 tons of reclaim rubber a day.

Operations at the plant are completely mechanized, according to the company, with the separate departments—cracking, fine grinding, fiber separation, mixing, straining, and refining—linked by a system of conveyors.

G. K. Trimble is president of the firm, and Charles E. Hart is factory manager. Other officials presiding at the tour were Mel MacDonald, sales representative, Carl Totsch, sales head, and T. E. Corcoran, Jr., purchasing agent and office manager.

New Midwest Rubber Reclaiming Co. Plant at Paramount, Calif.

Thiokol Gas Plugs Developed for Telephone Cables

A cold-setting gas plug for use in pressurized telephone cables has been introduced by Thiokol Chemical Corp., 780 Clinton Ave., Trenton 7, N. J. According to the company, the plug compound is based on a Thiokol liquid polymer and epoxy resin mixture, and is already being employed in toll and exchange cables of telephone systems throughout the country.

The two-package sealer requires mixing immediately before injection, the company says, and installation of plugs in small cables with this sealer can be done quickly by one man with few tools, in contrast to asphalt cable plugs which call for the attention of two men, heating equipment, and more elaborate tools. The mixture sets without shrinkage in 24 hours at 70° F. and has an estimated life-span of 20 years.

The cured compound is reported to be completely impermeable to gases and noncorrosive to metals. Its resistance to a wide range of aliphatic and aromatic solvents and to many corrosive chemicals may make it applicable to other fields, the company suggests.

Truck Tire 100,000 Miles Without Recap, Reports Goodrich

Traction Express, a truck tire designed for tractor-unit drive wheels and manufactured by The B. F. Goodrich Co., Akron, O., has been reported to average more than 100,000 miles on the road without a recap, according to J. E. Powers, manager of the company's truck tire sale.

This mileage exceeds that attained by regular truck tires plus single recaps, Powers says. The results are attributed to a 25-50% increase in the thickness of the Traction Express tread. However, new developments in rubber compounding and a design concept that compresses the rubber in the tread allows the tire to run without abnormal friction heat, Powers adds.

New Building for Radiator Specialty

Construction of a new addition to its Charlotte, N. C., plant has been begun by Radiator Specialty Co. Expected to be completed by January, 1955, the building will contain an enlarged machine shop, a rubber lathe cut goods department, and an expanded rubber laboratory. This is the firm's third such expansion in three years.

The company recently purchased all the rubber plumbing specialty molds from United States Rubber Co. and now manufactures more than 600 rubber plumbing specialty items for the trade.

Tires on Farm Equipment Widespread

More than 70 types of farm equipment are now using rubber tires, according to a recent survey made by The B. F. Goodrich Co., Akron, O. The tires range in size from wheelbarrow dimensions to those for large self-propelled combines, Goodrich says, and they give long service with little maintenance. The use of tubeless tires on many agricultural implements was also predicted.

Neoprene to Be Shipped in 1-1½-Inch Strips

Neoprene in the future will be shipped in 1-1½-inch strips instead of the 11-13-inch lengths hitherto used, according to the rubber chemicals division of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. The purpose of the change is to facilitate the stacking of the shipping bags on factory pallets. Processors will also benefit, du Pont says, by the simplification of handling of the material in dry processing and by the shortening of the time needed for solution in cement preparation by the slurry method.

The new neoprene unit load has a base size of 40 by 48 inches and is 30 to 36 inches high. Forty 50-pound bags are spot pasted and stacked on a fiber board which serves as the pallet. A four-inch lip protrudes on two adjacent sides of the load with connecting corner cut out so that the lips may be folded up if desired. The bags are color coded by means of a printed band at the extreme ends. Standard fork-lift trucks equipped with two inexpensive chisel forks can be used to remove unit loads from both truck trailers and box cars.

Du Pont requests that orders for neoprene be in multiples of ton quantities, although orders for less than 1,000 pounds will also be filled. To avoid breaking pallet units, the company reserves the right to adjust orders to the nearest ton. Full-scale use of the shortened strips will be achieved by January 1, 1955, or soon thereafter.

Borg-Warner Plans Stock Split

Borg-Warner Corp., 310 S. Michigan Ave., Chicago 4, Ill., will hold a special stockholders' meeting on December 10 to vote upon a proposed amendment to its Articles of Incorporation whereby the company's authorized common stock will be increased from three million to 12 million shares. If the amendment is approved, there will be a three-to-one split in the number of shares outstanding, to be effected in the form of a stock dividend, by distributing two additional shares with a par value of $5 each to each holder of one share of $5 par common now outstanding.

Company President R. C. Ingersoll explained that the purpose of the proposed amendment is to bring about a broader distribution of the corporation's common stock. He further declared that he will recommend to the directorate that, conditions permitting, starting next year a quarterly dividend of 42½¢ be declared on each share of common stock then outstanding.

Heyden to Absorb Nuodex

Heyden Chemical Corp., 342 Madison Ave., New York 17, N. Y., manufacturer and supplier of chemicals for the paint, protective coatings, and plastics industries, has announced that it has entered into a contract to purchase the outstanding common stock of Nuodex Products Co., Inc., Elizabeth, N. J.

According to the company, Nuodex's domestic sales volume for 1953 amounted to about $6,500,000, and the business done by its foreign subsidiary totaled $3,600,000 for the same year. Production of both companies was generally in similar categories. Financial terms of the deal were not revealed.

Plant Maintenance Show Scheduled for January 24-27

The sixth Plant Maintenance & Engineering Show, sponsored by Clapp & Poliak, Inc., New York, N. Y., will be held in the new $2,000,000 adjunct to the International Amphitheatre, Chicago, Ill., January 24-27. Reported to be one of the largest industrial expositions in the country, the show will be the most ambitious in its history.

The new hall will provide 188,000 square feet of floor space, with 2,400 square feet of unobstructed exhibit bays and headroom of 20-26 feet. Railroad sidings lead directly into the hall and accommodate 10 freight cars simultaneously. A 2,000-car parking lot will be available.

General sessions of the Plant Maintenance & Engineering Conference are to be conducted in the arena directly adjoining the exhibits. Last year's conference sessions attracted 2,200 engineers and production heads.

G-E Plastics Workers Set Safety Record

An industrial safety record in the plastics manufacturing field has been established by employes of General Electric Co.'s plastics department at Decatur, Ill., and Springfield and Taunton, Mass., according to the company. Since September 30, 1953, 2½ million accident-free hours have been achieved, G-E says.

E. W. Bickford, manager of employe and plant community relations for the plastics department, reports that the results can be attributed to a recent intensive safety program. Supervisors, invested with direct responsibility for carrying out the program, conducted safety meetings and delegated authority to safety representatives among workmen, Bickford states.

Protect Temperature-Control Systems with Geon

Constant and accurate temperature recordings in corrosive atmosphere and liquids can be maintained through the use of a Geon vinyl plastic covered capillary tubing, according to B. F. Goodrich Chemical Co., Rose Bldg., Cleveland, O., manufacturer of the plastic.

In most such temperature-relaying systems, flexible bronze tubing is employed to protect the 1/16-inch copper capillary tubing which is the nerves of the system, Goodrich says. The vinyl-on-bronze is a further insurance against corrosion and the breakdown of the system. Geon resists most acids, alkalies, salts, and oils, provides electrical insulation, and withstands temperatures up to 200° F.

Claremont Pigment Offers Vinyl Colors

The availability of a wide range of standard prematched vinylized colors for extruders of vinyl shoe welting, upholstery gimp, and luggage trim has been announced by Claremont Pigment Dispersion Corp., 110 Wallabout St., Brooklyn 11, N. Y. Suitable for incorporation into dry blend compounds by drum tumbling or proportioning meter attachments, the colors include town brown, mahogany, and fawn.

Goodrich to Establish Liberian Plantations, Double Foam Rubber Capacity

In a joint announcement by William V. S. Tubman, president of the Republic of Liberia, and John L. Collyer, chairman of The B. F. Goodrich Co. board of directors, it has been revealed that the Goodrich company plans to establish natural rubber plantations in Liberia.

A long-term concession has been granted Goodrich by the Liberian Government involving two separate areas totaling approximately 600,000 acres.

Goodrich technicians are now in Liberia working on the initial stages of this project.

Thus Goodrich, a pioneer in the field of synthetic rubber, will become a natural rubber grower on a commercial scale for the first time.

At about the same time F. M. Daley, president of the B. F. Goodrich Sponge Products Division, announced a $3,500,000 expansion program which will more than double the company's foam rubber production capacity in Shelton, Conn. The new foam rubber production facilities will occupy 460,000 square feet of floor space, and construction is scheduled for completion in December, 1955.

Greatly increased customer demand, reflecting the trend to foam rubber by the furniture and bedding industries, is responsible for the company's decision to expand its facilities, Daley said. The expansion will mean increased production of such foam rubber products as pillows, furniture cushion units, slab stock, mattress and automotive seat toppers, and foam-backed fabrics.

The Goodrich company on August 13 acquired ownership of the assets and business of the Sponge Rubber Products Co., which also has plants in Derby, Conn.; Fall River, Mass.; and a Canadian subsidiary in Waterville, P.Q.

Introduces Inflatable Fabric for Structural Use

An inflatable fabric said to provide the strongest known structural beam per unit weight has been introduced by the aviation products division of The Goodyear Tire & Rubber Co., Akron 16, O. Called "air mat," the material consists of two rubber-coated plies of fabric connected cross-sectionally by nylon threads of fixed length.

According to Goodyear, "air mat" weighs two pounds a square yard and is capable of containing high air pressures, providing excellent insulation against heat, cold, and vibration, in addition to strength comparable to metals. Bursting strength is rated at 20-200 psi.

"Air mat" was designed several years ago for use by the U. S. Air Force as quonset-type huts in Arctic weather. Possible commercial applications, Goodyear says, are as collapsible outdoor furniture, reel-out ladders for aircraft crash landings, theatrical scenery that would require minimum storage space when deflated, portable shelters for sportsmen, and liners for sleeping bags.

Goodyear reports that "air mats" are currently in use as inflatable work platforms at a West Coast aircraft factory in place of metal platforms that might damage planes. Goodyear will design, develop, and fabricate products to customer specifications, but will not sell the fabric in sheet form.

Longest Plastic Pipe Line

A 12-mile plastic pipe line, said to be the longest in the United States, was recently installed at Heidelberg, Miss., to carry unwanted salt water from 25 oil wells to a central disposal plant. Constructed of Kralastic, a plastic-rubber material made by Naugatuck Chemical division, United States Rubber Co., Rockefeller Centre, New York 20, N. Y., the pipe was fabricated by Southwestern Plastic Pipe Co., Mineral Wells, Tex.

Rate of installation of the 30-foot pipe sections was said to have been a mile a day because of their lightness of weight, flexibility, and strength. Cement-asbestos pipe had been used before for transporting caustic saline solutions.

Reinforced-Plastic Truck Interior Saves Weight and Space

A 20% saving in wight and a gain of 150 cubic feet of payload space has reportedly been achieved through the use of reinforced plastic structural beams and panels in the manufacture of a new refrigerated truck trailer.

The trailer's interior lining, structural beams, rear doors, rear door frame, and a reflector pan covering the underside were all constructed of Lamicor, molded glass-reinforced polyester resin made by Strick Plastics Co., Philadelphia, Pa. The resin used was Vibrin, a product of Naugatuck Chemical division, United States Rubber Co., New York, N. Y.

According to U. S. Rubber, the trailer, first shown during the recent convention of the American Trucking Association at New York, has a total weight of only 11,800 pounds, despite its 35-foot length, its sliding tandem wheel assembly, and its refrigeration unit. The molded materials are stronger than steel on a pound-for-pound basis, are clean and corrosion resistant, and have a high thermal insulating quality, the company says.

The new trailer is now being manufactured commercially by Strick Co., Philadelphia, Pa., parent firm of Strick Plastics Co. Production quota for the next year has been reported as 300.

Named to Nuclear Group

Phillips Petroleum Co., Bartlesville, Okla., has been named a member of the Rocky Mountain Nuclear Power Study Group, an association of nine companies formed by the U. S. Atomic Energy Commission to investigate the technical and economic feasibility of a nuclear reactor for the production of electrical power, fissionable materials, and radioisotopes.

Dunlop Changes Name

Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont., has changed its name to Dunlop Canada, Ltd., the firm announces. The alteration was made necessary because of the addition of many new lines of synthetics and for reason of mnemonics.

Solvay Begins Chloromethane Production at Moundsville, W. Va.

The chlorination of methane products was recently begun by Solvay Process Division, Allied Chemical & Dye Corp., at its new plant at Moundsville, W. Va., marking the firm's entry into the field of chlorinated organic chemicals. Methyl chloride, methylene chloride, chloroform, and carbon tetrachloride will be manufactured at the new facilities.

The site was chosen because of its proximity to brine and methane sources, according to the company, as well as its strategic position among industrial and consumer markets. Statistics released by the United States Tariff Commission reveal that increased demand has stimulated chloromethane production to an all-time high in 1953, with new industrial developments, especially in the rubber, plastics, and paint fields, forecasting still greater consumption.

Methyl chloride is employed in the production of butyl rubber and silicone resins. Methylene chloride is used in conjunction with cellulose acetate to make non-inflammable photographic film. Chloroform and carbon tetrachloride have been found valuable in the manufacture of refrigerants, in addition to their universal use as solvents.

National Aniline Building Diisocyanate Plant

Construction of facilities for production of diisocyanates in introductory commercial quantities has been begun by National Aniline Division of Allied Chemical & Dye Corp., at its Buffalo, N. Y., plant. Expected to be completed early in 1955, the new installation will produce 2,4-tolylene diisocyanate, various mixtures of isomeric tolylene diisocyanates, 3,3′ bitolylene 4,4′ diisocyanate (TODI), and p,p′ diphenylmethane diisocyanate (MDI).

According to the company, these diisocyanates are of particular interest to manufacturers of polyurethane rubber, foams, films, and adhesives and will shortly be made available in experimental quantities from small production units already in operation.

Tubeless Tires for Light 1955-Model Trucks

Tubeless tires are being shipped to major manufacturers of light trucks by The Firestone Tire & Rubber Co., Akron O., for installation as standard equipment on new 1955 models, according to Raymond C. Firestone, executive vice president of the company.

Alamask BD Again on Market

Rhodia, Inc., 230 Park Ave., New York 17, N. Y., has announced the reestablishment of Alamask BD for the reodorization of neoprene latex, alone and in combination with Alamask ND. The material had been withdrawn from the market by E. I. du Pont de Nemours & Co., Inc., prior to the transfer of du Pont's reodorant business to Rhodia.

NEWS ABOUT PEOPLE

George R. Lawson, vice president in charge of sales of Sharples Chemicals, Inc., Philadelphia, Pa., has been selected to participate in the advanced management program of the Harvard Graduate School of Business Administration. His position as sales director will be temporarily assumed by **Eugene N. Sidoroff.** Mr. Lawson has been with the firm since 1946 and was formerly a consultant in the Office of Production Research & Development.

Lester P. Bushnell has been named assistant production manager of the footwear and general products division of United States Rubber Co., New York, N. Y. Succeeding him as factory manager of the firm's Chicago, Ill., plant is **Edwin A. Martin.** Others promoted were **Raymond A. Herrly,** who becomes factory manager of the Mishawaka, Ind., plant; **Charles H. Baldwin,** now factory manager at the Santa Ana, Calif., plant; and **Alton D. Fordham,** responsible for special assignments.

Richard L. Frederick has been named director of industrial relations for The Timken Roller Bearing Co., Canton, O. Also promoted are **Ned N. Case** and **John T. Bonnot,** who became superintendent of labor relations and assistant superintendent, respectively, at the firm's Columbus, O., plant.

Clemens A. Seils has been promoted to adhesives and coatings division office manager of Minnesota Mining & Mfg. Co., Detroit, Mich. He has been with the firm since 1950.

Robert F. Harwick has been named assistant sales development manager of the rubber chemicals division of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., succeeding **F. L. Shackelford,** who has become chemicals sales manager of the dyes and chemicals division. Mr. Harwick was formerly associated with Gulf Refining Co., Gulf Oil Corp., and the *Oil & Gas Journal.*

Robert F. Harwick

Julian S. Pruitt has been assigned to the Detroit sales territory of Barrett Division, Allied Chemical & Dye Corp., New York, N. Y. Also named was **Evan E. Senuk** who will represent the firm in the southern New Jersey area; while **Lorne C. Stocker** will cover the Mid-Atlantic territory for the company.

A. N. Smith has been appointed manager of personnel and industrial relations at Shell Chemical Corp.'s plant now under construction at Norco, La. He served with the company in various technical positions between 1941 and 1951 and then was transferred to personnel administration work with Shell Oil Co.

John B. Webb has been named assistant secretary of Lee Rubber & Tire Corp., Conshohocken, Pa. He has served with the company since 1934.

Walter Bedell Smith, former U. S. Under-Secretary of State, has been elected vice chairman of the board of directors of American Machine & Foundry Co., 261 Madison Ave., New York 16, N. Y. According to the company, General Smith will have broad administrative duties and will exercise considerable influence in shaping the firm's policies.

Roger M. Kyes, vice president of General Motors Corp. and Deputy Secretary of Defense during the first year of President Eisenhower's administration, was the feature speaker at a luncheon given by the Association of National Advertisers at the Hotel Plaza, New York, N. Y., November 10, culminating the group's three-day annual meeting.

V. L. Peickii has been appointed director of research for National Motor Bearing Co., Inc., Redwood City, Calif. He will be in charge of product research engineering and development.

Marion N. Kershner, president of the National Association of Foremen, installed **A. L. Freedlander,** president of The Dayton Rubber Co., and **Nelson Montiera de Carvalho,** of Sao Paulo, Brazil, as members of the group's honorary Roundtable Society at the NAF's recent annual convention.

Donald E. McIntire has been named chief accountant-manufacturing for the industrial products division of The B. F. Goodrich Co., Akron, O., and his former position as manager of commodity costs, Plants 1 and 2, has been assumed by **Harvey F. Louthan.** Mr. McIntire has been with the firm since 1940; Mr. Louthan since 1926.

John A. Vormbaum has been named controller and contract administrator at Lunn Laminates, Inc., Huntington Station, N. Y. Mr. Vormbaum has had governmental service with the U. S. Corps of Engineers and the U. S. General Accounting Office and also has been associated with Lockheed Aircraft Service, Inc.

Max A. Minnig

Max A. Minnig has been elected executive vice president of Witco Chemical Co., 260 Madison Ave., New York 16, N. Y. He joined the firm's natural gas division in 1946 and became, successively, national sales manager for rubber chemicals, director of sales, and vice president.

H. Newman Roberts has been appointed western division manager for the tires division of United States Rubber Co., with headquarters in Los Angeles, Calif. His former position as southern division manager will be assumed by **Henry B. Murphree. James B. Jackson** becomes district manager in Atlanta, succeeding Mr. Murphree.

Edward J. McDonald, secretary and treasurer of Seamless Rubber Co., New Haven, Conn., has been elected to membership in the Controllers Institute of America.

Charles L. Fulkert has retired from his position as vice president of Stokes Molded Products Division of Electric Storage Battery Co., Trenton, N. J. In 1903 he had been appointed factory superintendent of Joseph Stokes Rubber Co. and had served in that capacity for 34 years. He was promoted to vice president of that firm in 1938 and then moved into the sales department. When the company was purchased by Electric Storage Battery in 1946, Mr. Fulkert was named vice president and a director.

J. E. Trainer, executive vice president and a director of The Firestone Tire & Rubber Co., Akron, O., has been named a life member of the American Society of Mechanical Engineers. He also holds membership in the U. S. Chamber of Commerce Committee on National Defense, is a trustee of Pratt Institute, a member of the National Board of Directors of the American Ordnance Association, chairman of the executive committee of the Artillery Division of the American Ordnance Association, and a member of the Professional Engineers & Surveyors and the Society of Automotive Engineers.

Melbourne P. Binns has been named senior salesman for the St. Louis territory of Sharples Chemicals, Inc., Philadelphia, Pa. He started with the firm in 1952.

H. E. Selby

H. E. Selby has joined the technical sales staff of The C. P. Hall Co., Akron, O. He was formerly associated with General Cable Corp., International Plastic Corp., McCordi Corp., and Bishop Mfg. Corp.

Warren B. Thompson has become a sales representative in the Middle Atlantic territory for Rhodia, Inc., New York, N. Y. Among Mr. Thompson's responsibilities will be the handling of the output of the firm's industrial reodorant division, which produces products for odor abatement in the rubber industry.

Chester D. Rudolf and **William D. Jones** have joined the silicate, detergent, calcium division of Diamond Alkali Co., Painesville, O. Mr. Rudolf comes from New Jersey Zinc Co.; while Mr. Jones formerly served with Hercules Powder Co., Battelle Memorial Institute, and Rohm & Haas Co.

Clifford E. Otto has become Metropolitan New York district manager for Tru Cast beryllium copper mold components of Manco Products, Inc., Melvindale, Mich. Before joining the company, he had been with American Cyanamid Co., Traveletter Corp., and Schneiel Bros. Corp.

Orrin K. Feikert has been named manager of the truck tire sales department of Seiberling Rubber Co., Akron, O., and **Frank G. Hager** has been appointed assistant manager of the department, succeeding **C. Sterling Parker**, who has resigned.

W. F. George has been appointed special assistant to the president of Witco Chemical Co., New York, N. Y. He formerly was with Hooker Electrochemical Co. and at one time organized and managed W. F. George Chemicals, Inc. He was also co-publisher of *Chemical Industries*, now known as *Chemical Week*.

H. E. Hughes has been appointed assistant technical superintendent at Shell Chemical Corp., Houston, Tex. Succeeding him as chief engineer is **J. W. Hyde. C. W. DeLong** has been named assistant chief engineer.

Eugene F. Gibbons has been named to the sales promotion staff of The Goodyear Tire & Rubber Co.'s chemical division, Akron, O. Formerly, he served with Lubrizol Corp., *Petroleum Processing Magazine*, and Designers for Industry, Inc.

Edward G. Gerbic has been named vice chairman of the Association of National Advertisers, 285 Madison Ave., New York 17, N. Y., replacing **Guy Berghoff**, who has resigned. Mr. Gerbic is vice president of Johnson & Johnson, New Brunswick, N. J.

Michael J. Batenburg has been appointed director of information services of Pittsburgh Plate Glass Co., Pittsburgh, Pa., and **Richard W. Dittmer** has been named manager of public relations. Also advanced was **Norman L. Park**, now manager of publications.

James D. D'Ianni, assistant to the vice president, research and development, The Goodyear Tire & Rubber Co., Akron, O., represented the American Chemical Society when Mount Union College inaugurated its new president, Carl C. Bracy.

Arthur B. Warner has been promoted to factory superintendent at the main plant of Minnesota Rubber & Gasket Co., Minneapolis, Minn. He has been with the firm for two years and formerly had been proprietor of his own floor-tile business.

James W. Gilman has been appointed Pacific Northwest sales representative for the plastics and resins division of American Cyanamid Co., New York, N. Y. He joined the firm in 1945, having previously been associated with Old Colony Paint & Chemical Co.

Edwin D. Meade has been named manager of industrial products sales, mechanical goods division, United States Rubber Co., New York, N. Y. He will make his headquarters at the Fort Wayne, Ind., plant of the company, which he joined in 1935.

George Waite has been named sales director of Tech-Art Plastics Co., Morristown, N. J. Previously he had served with The Firestone Tire & Rubber Co., Celanese Corp. of America, and the plastics division of Curtiss-Wright Co.

J. C. Wright, Jr., has been named sales manager, and **R. A. Smart** and **R. S. Harper** have been promoted to account executives, of the manufacturers sales office of The Goodyear Tire & Rubber Co., at Detroit, Mich.

John R. Pfann has been named sales analyst for Sharples Chemicals, Inc., Philadelphia, Pa., replacing **J. W. Conyers, Jr.**, who has been transferred to the market development department. Mr. Pfann served formerly with E. I. du Pont de Nemours & Co., Inc., and joined Sharples in 1952.

Arthur M. Brooks has joined the market research and development department of Columbia-Southern Chemical Corp., Pittsburgh, Pa. He had been with Raffold Process Corp. since 1922.

Gerald N. Vriens has been appointed a group leader in the intermediates and rubber chemicals development section of American Cyanamid Co., Bound Brook, N. J. He has been with the firm since 1949.

Carl C. Svoboda has been placed in charge of purchasing construction and raw materials for Mobay Chemical Co., St. Louis, Mo. He has been associated with Monsanto Chemical Co. since 1930.

Arthur S. Locke has been appointed associate director of the West Orange, N. J., laboratory of Vitro Corp. of America. For the past eight years he was consultant in the radar division of the Naval Research Laboratory, Washington, D. C.

H. I. Gibson has been named manager of the Corporal Guided Missile Division of The Firestone Tire & Rubber Co., Los Angeles, Calif. Before joining Firestone in 1934, he had been associated with Ford Motor Co.

P. W. Perdriau has been appointed director of employe relations for The B. F. Goodrich Co.'s tire and equipment division, Akron, O. He has been with the firm since 1934.

C. Paul Fortner has been elected vice president in charge of research and development of Plax Corp., West Hartford, Conn. He has been with the firm since 1952.

Joseph S. Detwiler has been appointed export manager for Taylor Instrument Cos., Rochester, N. Y., effective February 1, 1955. Associated with the company since 1932, he supervised the introduction and development of the firm's Time Cycle Controller, and is responsible for the adaptation of instrumentation to the making of foam or sponge rubber. During the late war, he was in charge of Taylor's synthetic rubber program.

Joseph S. Detwiler

OBITUARY

Theodore A. Haschke

Theodore A. Haschke, sales director of the industrial chemical division of Stauffer Chemical Co., New York, N. Y., and a director of Old Hickory Chemical Co., Old Hickory, Tenn., died October 5 in a New York hospital. He was 56.

Mr. Haschke was born and educated in Austin, Tex., and served with the U. S. Army during World War I. He entered business as a salesman for Round Rock White Lime Co. and subsequently joined Stauffer in 1926 as a salesman in the Houston territory.

He was a member of the Siwanoy Country Club, The Chemists' Club, the Uptown Club, and the Salesmen's Association of the American Chemical Industry.

Surviving him are his wife, mother, sister, and seven brothers.

Gilbert H. Turner

Gilbert Haller Turner, since September, 1948, director of industrial relations for The Timken Roller Bearing Co., Canton, O., died October 9.

He had been associated with the firm since June, 1928, in various sales, engineering, legal, and labor capacities.

The deceased was born in Pittsburgh, Pa., 48 years ago. He was educated in local public schools, Peabody High School, Carnegie Institute of Technology, and William McKinley Law School.

He had held membership in Kappa Sigma, Evangelical United Brethren Church of Pittsburgh, and the Columbus Athletic Club.

Glen S. Hiers

Glen Sefton Hiers, 58, assistant director of research for Collins & Aikman Corp., died suddenly, September 7, while en route by train to Akron, O.

Dr. Hiers attended Miami University, Northwestern University, and the University of Illinois.

He served in the Chemical Warfare Service during World War I and was associated with E. I. du Pont de Nemours & Co., Inc., between 1926 and 1928. He then joined Collins & Aikman, where for 26 years he did research on latex, rubbers, foams, and elastomers and their relation to fibers, yarns, and fabrics. Forty-three U. S. and foreign patents were granted him.

He was an active member of the Division of Rubber Chemistry, American Chemical Society, and of the American Association of Textile Colorists & Chemists. He also belonged to several other technical societies and to Phi Kappa Tau, Phi Beta Kappa, Sigma Xi, and Phi Lambda Upsilon.

The deceased leaves a wife and two sons.

James B. Conley

James B. Conley, for 26 years sales representative for Peerless Cement Co., Inc., Stoughton, Mass., died September 1 after a long illness.

Before coming to Peerless in 1928, he had been associated with Firestone Tire & Rubber Co. (1926-28) and United States Rubber Co. (1923-26).

The deceased was born in Brockton, Mass. He was graduated from the local high school in 1900.

A High Requiem Mass was sung at Our Lady of Lourdes Church, Brockton, on September 4.

Surviving him are two daughters.

CALENDAR

Nov. 17.	**Washington Rubber Group. Chemical Market Research Association. Sheraton Cadillac Hotel, Detroit, Mich.**
Nov. 17-19.	**ASTM Committee 9, Electrical Insulating Materials. Hotel Carter, Cleveland, O.**
Nov. 18.	**Rhode Island Rubber Club. Metacomet Golf Club, East Providence, R. I.**
Nov. 24.	**Reinforced Plastics Group, New York Section, SPE.**
Dec. 2.	**Fort Wayne Rubber & Plastics Group, Van Orman Hotel, Fort Wayne, Ind.**
Dec. 2-3.	**Rubber & Plastics Division, ASME. Hotel Statler, New York, N. Y.**
Dec. 2-7.	**Twenty-First National Exposition of Power & Mechanical Engineering. Commercial Museum, Philadelphia, Pa.**
Dec. 4.	**Miami Valley Section, SPE. Christmas Party. Hartwell Country Club.**
Dec. 6-8.	**Chemical Specialties Manufacturers Association. Annual Meeting. New Yorker Hotel, New York, N. Y.**
Dec. 7-9.	**Third Annual Wire & Cable Symposium. Berkeley Carteret Hotel, Asbury Park, N. J.**
Dec. 8.	**Buffalo Rubber Group. Christmas Party. Buffalo Trap & Field Club, Williamsville, N. Y.**
Dec. 9.	**Northern California Rubber Group.**
Dec. 10.	**Detroit Rubber & Plastics Group, Inc. Christmas Party. Sheraton Cadillac Hotel, Detroit, Mich.**
	New York Rubber Group. Christmas Party. Henry Hudson Hotel, New York, N. Y.
	Boston Rubber Group. Christmas Party.
Dec. 12-15.	**American Institute of Chemical Engineers. Annual Meeting. Statler Hotel, New York, N. Y.**
Dec. 1 .	**Chicago Rubber Group, Inc. Christmas Party. Morrison Hotel, Chicago, Ill.**
Dec. 18.	**Southern Ohio Rubber Group. Christmas Party.**
Dec. 22.	**Reinforced Plastics Group, New York Section, SPE.**
1955	
Jan. 19.	**Washington Rubber Group.**
Jan. 24-27.	**Sixth Plant Maintenance & Engineering Show. International Amphitheatre, Chicago, Ill.**
Jan. 28.	**Akron Rubber Group, Winter Meeting. Mayflower Hotel, Akron, O.**
Jan. 31-Feb. 4.	**ASTM Committees D-11 and D-20. Netherlands Plaza Hotel, Cincinnati, O.**

Buffalo Group

(Continued from page 249)

forcing Pigments," and Mr. Fisher after dinner discussed "Rubber Roads."

The more positive the contact potential of the pigment, Mr. Havenhill asserted, the better the reinforcement, since the rubber has a negative potential and, therefore, unlike forces attract. He presented methods of adding oils and pigments to the rubber in the Banbury mixer according to the potentiality of the materials to gain better tensile strength.

Discussing the advantages of rubberized roads, Mr. Fisher cautioned that the ideal rubber-asphalt mixture was still to be determined before such highways can compete on an operating cost basis with standard roads.

Glen Meyers, of J. O. Meyers & Sons, chairman of the Group, presided over the meeting, which was held at the Hotel Westbrook, Buffalo, N. Y., and which attracted 50 members and guests.

Bureau of Standards Sponsors High Polymer Lecture Series

The National Bureau of Standards' division of organic and fibrous materials, Washington, D. C., is sponsoring a series of six lectures on the chemistry and physics of high polymers. Open to the general public, the talks will be given in the materials testing laboratory on the Bureau grounds at 2:30 p.m. of the designated days. The program has been announced as follows:

November 1, **"Relaxation Processes in Dilute Polymer Solution,"** Bruno H. Zim, General Electric Co.

December 6, **"Peroxides as Initiators of Chain Reactions,"** Arthur Tobolsky, Princeton University.

February 7, 1955, **"Some Fundamental Properties of Polymer Latices,"** Turner Alfrey, Jr., Dow Chemical Co.

March 7, **"The Physical Chemistr Macromolecules Having Helical figuration—Polypeptides, N Ac, and Collagen,"** Paul Dot ard University.

March 28 (tentative), **"Nuclear Magnetic Resonance and Structure of Polymers,"** H. S. Gutowsky, University of Illinois.

May 2, **"Mechanism of Degradation and the Fine Structure of Cellulose,"** Eugene Pacsu, Princeton.

Financial

American Cyanamid Co., New York, N. Y., and subsidiaries. First nine months, 1954: net earnings, $19,697,317, equal to $2.17 each on 8,717,554 common shares, compared with $22,628,469, or $2.60 each on 8,646,261 shares, in the 1953 months; net sales, $293,326,188, against $287,301,694.

Diamond Alkali Co., Cleveland, O. Nine months ended September 30, 1954: net profit, $4,328,882, equal to $1.74 each on 2,265,223 common shares, against $4,414,340, or $1.77 a share, in the 1953 months: net sales, $70,988,638, against $65,507,099.

Monsanto Chemical Co., St. Louis, Mo., and subsidiaries. First nine months, 1954: net earnings, $16,445,881, equal to $3.04 each on 5,270,051 common shares, against $19,687,960, or $3.65 a share, in the like period last year; sales, $253,218,508, against $257,636,965.

(Continued on page 304)

NEWS FROM ABROAD

MALAYA

Mudie Report Recommends Increased Replanting, Change in Taxes, More Research

The 75-page report of the Mudie Mission of Enquiry into the rubber industry of Malaya has now become available. It is for the most part a thorough piece of work which attempts to give a clear presentation of the situation in the Malayan rubber industry and carefully weighs all pros and cons before making recommendations.

From the outset the mission strikes the keynote, at which it continues to hammer throughout: the need of efficient replanting and the dire results likely to follow if prompt and vigorous action is not taken. Synthetic dyes killed the indigo plantation industry, and the synthetic could kill the plantation rubber industry, no matter what its potential output, if it cannot bring quality and costs to the same level as those of synthetic. What this state of affairs would mean to Malayan economy is shown by the facts that in 1952 exports of rubber and latex from Malaya accounted for $1,287,000,000 (Straits), or 60% of the value of total exports, and that in 1953, 280,000 persons worked on estates, or 56% of total recorded employed population; with those employed on smallholdings, a total of close to 500,000.

Production and Acreages

Before remedies are discussed, the distribution of the planted area among smallholdings of less than 100 acres, and estates of more than 100 acres, is examined as well as the status of Malaya as producer of rubber.

In 1953 the estates, with 54% of total planted acreage, produced 60% of Malayan rubber; the smallholders, with 46% of the acreage, produced the remaining 40% of output. There were 2,489 estates, of which more than 75% ranged from 100 to 999 acres; 454 were between 1,000 and 2,999 acres; 96 between 3,000 and 4,999 acres; and 53 had acreages of 5,000 and over. The smallholdings numbered 392,482, of which all but 7,274 were under 25 acres.

In recent years Malaya's role as supplier of new rubber has suffered a decline both in relation to total world rubber production (including synthetic) and to that of natural rubber alone. In the middle 1920's, when Indonesia was her chief rival, Malaya contributed 40% of the total new rubber supplies: in 1953, with synthetic rubber included, her share fell to 22% of the total for all rubbers, and to 33% for all new natural rubber supplies. From 1949 to 1953, yearly production in Malaya fell from 670,000 to 573,000 tons; this figure represented a reduction of 59,000 tons, or 15% in estate rubber, and 38,000 tons, or 14%, in smallholder rubber. At the same time, the yield per acre on estates declined from 541 to 473 pounds per acre, mostly on areas of ordinary seedlings.

Aging of older trees was chiefly responsible for the decrease on estates as well as on smallholdings, for old trees give lower yields.

The Case for Replanting

Difference in yield per acre was found to be the chief cause of difference in costs, which vary considerably from estate to estate. It is estimated that an estate planted with old, low-yielding rubber would pay out 40% of total costs per pound for tapping, 30% for general charges, depreciation, and maintenance of the plantation, 12% for cultivation, and 8% for processing, packing, and dispatching. It was shown that by substituting new, high-yielding material, tapping charges could be reduced by 35%, general charges by 60%, and cultivation by 65%, per pound.

The recommendations regarding replanting are based on the economic life cycle of *Hevea*, considered to be 30-35 years. In the first seven years plantations are immature and unproductive; thereafter output rises rapidly to reach a peak at 15 to 17 years, when a slow, steady decline sets in until yields become uneconomic and the tree eventually dies. It is generally accepted that rubber plantations should be completely renewed every 30 years. How inadequate replanting has been since the war is shown by the consideration that at a rate of replanting of 3% yearly, resulting in complete renewal in 30 years, Malaya should now have 780,000 acres of immature rubber; but in 1953, the immature area was actually only 420,000 acres.

But this is not all: of the total planted area of 3,728,000 acres, consisting of 856,000 acres of superior material and 2,872,000 acres of ordinary seedling trees, more than half the seedling area is now more than 33 years old.

If no replanting is done from now on, the report estimates, then by 1964 the net increase in production will be only 20,000 tons (the difference between 1964 output from what is now immature area, and loss from present mature area, which will become unproductive by then); and by 1973, figuring along the same lines, there would be no gain, but a net loss of 140,000 tons.

If present prices continued, it is added, Malaya might be able to export the same amount as now for the next 10 years, but if prices fall just about the time when, owing to lower yields, costs rise, then many will be put out of business.

"If the present state of affairs is allowed to continue, and nothing is done to secure an adequate rate of replanting over the industry as a whole, the end of the rubber industry in Malaya, as we know it, is inevitable within the next 15 or 20 years."

Under the circumstances it is held imperative to replant as much as possible over the next three years; estates should replant at double the present rate. If they replant 30,000 acres in 1954, as they did in 1953, and 60,000 acres yearly thereafter, and at the same time smallholders complete their replanting scheme by 1959, as planned, production should be 600,000 tons by 1964 and 940,000 tons by 1973.

Replanting by Estates

Most large estates make provision for replanting at the rate of 3% yearly, aiming at complete replanting of estates within about 30 years, but many, especially of the smaller estates, make no such regular provision. To enable all estates to make regular provision for replanting, as the Mission recommends, a much more adequate replanting cess is required than that now levied, which vanishes when the price is 60 cents a pound (Straits) and increases so slowly above that level that at $1 a pound it is only 1.8 cents.

Instead of this schedule, the report suggests a flat rate of 4.5 cents a pound, which would not vary with the price; also a Replanting Fund into which the proceeds of the cess would be placed to the credit of individual estates and on which estates would draw only to finance replanting. Adequate arrangements would have to be made to allow estates to borrow and also to return to them surplus balances they may have accumulated. The Fund would require financing up to $40,000,000 (Straits). The scheme insures that each estate makes a minimum provision for replanting; its success will, if it is adopted, depend on the support it gets from government and industry, the report emphasizes.

Replanting for Smallholders

In the past 20 years, output of smallholder rubber increased only 28%, and again old, low-yielding rubber areas are major factors. About half the smallholdings are 33 years old, one-quarter is 24 to 33 years old, and only 7% was planted during 1946-1953. Available evidence points to the conclusion that yield per acre of existing mature trees will decline 20-50% in the next 10 years, and even faster in some localities.

The Mission finds that in its general conception the existing scheme for smallholders is along the right lines. But the future working of the scheme involves certain dangers. The special problems of replanting for the smallholder are considered, and the Mission suggests aid in clearing land and laiang weed control, and that advice be given on the economic and business aspects of replanting, but it does not favor an increase in the present grant of $400 per replanted acre. It adds that applications for grants have so far come mainly from those with larger holdings, advantageously situated with regard to opportunities for recouping loss of income due to replanting. To induce investment of fresh capital in the rubber industry by smallholders, a review is recommended o[illegible] federal land use policy, to permit alienation of new land for rubber. This, it is felt, would have an important psychological attraction and would tend to satisfy the great land hunger of smallholders.

Taxation

The question of taxation is fully discussed with a view of offering means to reduce costs and at the same time make investment in Malaya more attractive. The present export tax is considered too high when prices are low and not nearly high enough when prices soar, and a modified form is recommended which does not commence until rubber is more than 60 cents per pound, but increases very rapidly when the price is more


for the BEST...
in rubber and plastics
LOOK TO MUEHLSTEIN
For example—POLYSAR KRYNAC
MUEHLSTEIN is the exclusive agent in the United States for
POLYMER CORP., LTD. OF SARNIA, ONTARIO, CANADA.
POLYSAR KRYNAC—A medium oil resistant butadiene acrylonitrile polymer is made by the "Cold Process." It is engineered to assist the processor—Its characteristics include:
Easy processing—inherent resistance to scorch—easy identification—fast extrusion rate.
The use of POLYSAR KRYNAC results in oil resistant products exhibiting high tensile strength and elongation—long flex life—good low temperature flexibility—high abrasion resistance—superior age resistance.
Complete technical service and laboratory facilities are yours for the asking. Call us for your copy of our new POLYSAR KRYNAC Compounding Manual.
H. MUEHLSTEIN & CO. INC.
60 EAST 42nd STREET, NEW YORK 17, N. Y.
CRUDE RUBBER · SYNTHETIC RUBBER · SCRAP RUBBER · HARD RUBBER DUST · PLASTIC SCRA
REGIONAL OFFICES: Akron · Chicago · Boston · Los Angeles · London · Toront
WAREHOUSES: Akron · Chicago · Boston · Los Angeles · Jersey Cit

than 79 cents per pound. Referring specially to smallholders, the Mission recognized that the export tax provides practically the only way to get income tax from them, but pointed out that since they produce no other crop for sale but rubber, they pay a heavy export duty which, in percentage of their income, is equivalent to far more than would be reasonable or expected in any income tax scheme.

In order to make up the immediate reduction of revenue resulting from the reduced export tax, alternate sources are proposed: a distributed profits tax on gross amount paid by companies as dividend; increased personal income tax particularly at higher income levels, and increased import duties on luxuries and semi-luxuries.

Attracting Fresh Capital

The report sees very little chance of attracting new outside capital for rubber in Malaya since under present political conditions in Southeast Asia, potential investors evidently consider that the probable rewards are not worth the risk. The danger of such an attitude, it is pointed out, is that it may spread to a general reluctance to invest in Malaya at all. Restoration of confidence is therefore of the utmost importance. Here attention is drawn to a lack of mutual confidence between government and the industry, sensed by the Mission, which may be due to the fact that so many of the leaders of the industry do not live in Malaya. Whatever the causes, it is insisted that everything possible be done to remove them.

Research

Rapid expansion of research into fundamental and applied problems is recommended, in particular in chemical work on latex, its products, and possible derivatives. An increase in the Malayan Rubber Fund cess from 0.5- to 0.75-cent per pound is suggested, with the proviso that at least 0.5-cent be used solely for research, technical development, and advisory services.

Unemployment

The question of unemployment is very briefly treated, obviously because the Mission feels that this problem is one for the government to tackle. The Mission finds no indication of large-scale unemployment in the near future, but makes it clear that it does not think the rubber industry should be responsible for its own unemployed.

Comment on the Mudie Report

To no one's surprise the Mudie report has evoked much criticism, but oddly enough, so far, this has been directed chiefly to the Mission's advice not to increase the subsidy to smallholders. Obviously the Federation Rubber Replanting Board shares the general view and is understood to have recommended that the grant be raised to $500 an acre. While some felt that the Mission had not given enough consideration to smallholders, others scoffed at the land hunger ascribed to this group.

Penang rubber men characterized as "bilge" the statement that so many leaders of the rubber industry do not live in Malaya. The real leaders do, they emphasized, for the real leaders are not the directors abroad, but the planters, visiting agents, secretarial firms, here.

Local Scheme Favored

Various prominent personalities seem to favor a local scheme submitted to the Federation Government in March by the Rubber Producers' Council. This is said to be similar in many respects to the Mudie plan, but is claimed to be cheaper and better. For one thing it does not drastically cut revenue when prices are low. The R.P.C. scheme recommends that the government continue its present system of calculating export duty, but that it limit its share to the prewar rate of 2½% *ad valorem,* making the balance available as a replanting fund. It also suggests that estates be permitted advances up to the amount of credits and be left free to plant or replant.

The Rubber Growers' Association is in favor of the local scheme, Sir John Hay, chairman of the Association, reportedly stated. With regard to the Mudie report, he is quoted as saying that he did not think that "the gloomy forebodings are quite justified on the facts," and he objected that the replanting scheme proposed denied freedom of action.

The Mudie report will be the subject of a general debate in the Federal Legislative Council in December, it is learned. Many of its recommendations, particularly those relating to taxation, will have to be considered by the government in connection with the report the International Bank Mission is expected to make shortly.

More Paper Packaged Rubber Shipped

Malaya is also to ship rubber overseas in the paper bags made for the purpose by the Netherlands firm, Veth's Papierzakken Fabriek, Amsterdam. A member of that firm, in Malaya to promote the sale of these bags, reportedly stated that there was a big demand for them in the United States, and that they were also arousing interest in Germany. Indonesia was regularly shipping rubber packed in paper bags to the United States, and Ceylon had begun to use these bags in packing thick pale crepe for the United States, it was added.

Local rubber men will be able to inspect two sample bales of rubber so wrapped, which were scheduled to arrive here in October, and the first regular shipments of rubber in these bags from Malaya are looked for within the next month or so.

GREAT BRITAIN

BRPRA Reports Advances in Rubber Research

The BRPRA report for 1953 makes stimulating reading, providing as it does a survey over the wide-ranging endeavors of that body.

In his introduction the director of research, L. C. Bateman, comments that while previous reports have described advances in the understanding of the basic science and technology of rubber and progress toward practical development, emphasis in 1953 swung noticeably in the commercial direction.

Graft Polymers

Among the most interesting of the new developments is probably the work on graft polymers which has now progressed from the laboratory to the pilot plant. Methyl methacrylate and styrene grafts were produced in sufficient quantity to permit distribution not only to the technology department of the BRPRA, but also to outside firms for independent examination.

Detailed studies of their formation and chemical properties indicated that the attached polymer chains are unexpectedly short and that attachment is critically dependent on the catalyst used; peroxides give considerable attachment; azobis*iso*butyronitrile gives almost none, and persulfate systems have an intermediate effect.

Graft polymers from other monomers were also studied, and it was found that there are limits to the monomers which can be combined (e.g., vinyl acetate cannot), and further work has therefore been directed toward three-component systems. Improvements in certain properties, as tear resistance, seems possible this way.

The effect of small quantities of rubber in various forms in materials such as polystyrene also received attention.

Some novel modified rubbers were obtained by a new preparative technique, and a broader survey is being undertaken.

Fundamental Research

In the field of fundamental research, new knowledge gained on the nature of cross-linking in simple rubber-sulfur cures has paved the way for investigations of other ingredients, and novel developments are expected to result from the studies on the effects of amines, particularly of the amine and sulfur in the same molecule.

The recently constituted Polymer Chemistry Group conducted experiments in connection with degradation and stress relaxation which led to the conclusion that in peroxide vulcanization at temperatures between 70 and 120° C. bond rupture occurs at the cross-links and not in the part of the chain between the cross-links.

The Group also showed that chemical combination of carbon black with scission fragments of rubber takes place readily during cold milling, initially resulting in the formation of "tight" insoluble gel which breaks down on further milling. Formation of this gel is inhibited by the addition of a substance more reactive to the fragments than the black, as tetraphenyl hydrazine. Silica reinforcing fillers behave similarly.

Recent studies throw new light on the composition of natural rubber which will have significant technological consequences. Instead of consisting solely of linear molecules, the rubber hydro-

carbon, as it issues from the tree, was found to contain up to 20% of cross-linked, sub-microscopic particles, termed microgel, the presence of which greatly affects certain properties, particularly the hardness of coagulated rubber. A method was devised for removing the microgel portion.

Latex

The latex section dealt with zinc oxide stability of latex, the protein constituents of latex, the impregnation of leather with latex (which has been shown to be practicable on a factory scale), and the effect of polymeric glycol on the gelling characteristics of latex foam. It appeared that when polymeric glycols are used, gelation temperature can be varied with ease by simple changes in the composition of molecular weight of the glycol; while the foams show high stability at room temperature. Tests to produce foam sheet by a continuous foaming process from latex heat-sensitized with a polyglycol are in progress on an industrial scale and are said to be giving encouraging results.

Technology

A fruitful undertaking of the Technology Group was the study of plasticizer action in connection with work on low temperature of rubber. A theory of plasticizer action was developed permitting screening of useful plasticizers, and now, it is claimed, natural rubber compounds have been prepared which are superior to synthetic rubber in low-temperature performance and physical properties.

The Rubber Technical Developments Division during 1953 made further progress in work on cyclized rubber, fluid rubber, and Positex. Hitherto the chief concern of RTD was the application of cyclized rubber for shoe soling, but other fields have been recognized and will be explored. The possibilities for fluid rubber have been extended to printers' rolls and ebonites. Samples of fluid rubber have been supplied to several manufacturers for independent evaluation.

Manufacturer interest in Positex treatment of woolen goods was very slow, it is reported, until a maker of sportswear offered Positex-treated football hose to the trade and met with such excellent response that other manufacturers are now following his example. A newer use for Positex is in bonding fabric of unwoven fiber intended for use as garment linings or upholstery. Engineers of the BRPRA have designed and built special machinery for producing the material in continuous lengths.

GERMANY

New Plastic Materials

Badische Anilin-und Soda-Fabrik, A.G., and Dr. F. Raschig, G.m.b.H., Ludwigshafen, have together developed a new material for use in the construction of chemical apparatus. Bascodur, as this material has been named, is made with a high content of prepared fillers such as graphite, coal, coke, or the like, in a resinous binder based on phenol-modified, hardenable condensation products.

Bascodur is claimed to possess excellent corrosion resistance to most organic and inorganic acids, also in the presence of solvents, and is stable up to a temperature of 160° C. The material is intended for use in the acid industry, where the resistance of other materials like rubber or synthetic thermoplastics no longer suffices. By proper selection of the resin, Bascodur can be made resistant to alkalies and to some extent also both alkali- and acid-resistant.

Some of its physical properties are: bulk density, 1.8 g/cm^3; tensile strength, 200 kg/cm^2; compression strength, 1050 kg/cm^2; bending strength, 400-600 kg/cm^2; impact-bending strength, 2.2-3.5 cm/kg/cm^2; permanent heat resistance, 140° C.; thermal conductivity, 2.4-3 k cal/m/h/° C.; heat expansion coefficient, 20-100° C., 11-15 $\times$ 10^{-6}/m/m° C.; Martens dimensional stability, 150° C.

Bascodur molding compound can be compression-molded at pressures of 150-200 kg/cm^2 at 160-170° C. Profile material and tubing can be extruded; the latter is said to be absolutely impermeable to gas and liquids and cheaply producible in endless lengths. The use of Bascodur for heat exchange purposes is limited by its relatively low thermal conductivity, which is still above that of PVC, for instance. Thin-walled Bascodur tubing cemented in iron pipes makes connecting tubes for chemical apparatus, or unarmored thick-walled Bascodur tubes may be used, if care is taken to lay them where they are not exposed to mechanical injury. It is understood, however, that a Bascodur compound is now being developed with high impact resistance, for special purposes.

With the aid of cements made from similar basic materials as Bascodur, structural elements of Bascodur can be assembled into a wide variety of unsupported apparatus as reaction towers, strippers, suction apparatus, filter presses, etc. The cements also adhere well to iron, permitting the production of Bascodur-lined iron chemical equipment for working under pressure.

The new material has been successfully used for lining acid pumps and their parts, it seems, also for lining boilers and containers and for covering laboratory tables, and finally is understood to be serviceable for certain machinery parts.

Among other comparatively recent developments by Badische Anilin may be mentioned Luvican M 170 and impact resistant polystyrenes, especially Polystyrol EB.

The polyvinyl carbazole marketed in Germany as Luvican M 170 is an improved successor to the prewar Luvican M 150, developed by I. G. Farbenindustrie. Badische worked out a new, improved polymerization process claimed to yield a product having markedly higher heat resistance than the prewar material. M 170 is a thermoplastic amorphous, glassy, transparent material of a faintly yellow color; it lends itself to extrusion and pressing and can be cut and polished. Its mechanical properties remain largely unchanged up to 170° C.; from about 200° C. it is stretchable. Up to 180° C. it is very resistant to water, water vapor, lyes, salt solutions, in any concentration; up to 100° C., M 170 has good resistance to oxidation and reduction materials and acids, except concentrated nitric, sulfuric, and chromic acids; M 170 is insoluble in alcohol, esters, ethers, ketones, carbon tetrachlorides, aliphatic hydrocarbons, paraffin mineral oils, castor oil, and transformer oil.

Activated White Fillers Inhibit Polyisobutylene Plastic Flow

That plastic flow in polyisobutylene can be inhibited by the use of active white fillers is shown by A. Weihe[1] who found that when high molecular weight polyisobutylene, like Oppanol B 200 (produced by Badische Anilin & Soda-Fabrik), was compounded with 10 to 20% of oxides of metals of Groups 2, 3, and 4 of the periodic table, and of the iron group, it produced films and molded parts which show surprisingly high reversible extensibility and which retain their shape to a considerable degree under compression.

Oddly enough, no such effects were obtained in similar tests on other plastics, such as polyethylene, PVC, and polyvinylisobutyl ether. In the case of PVC, it was observed that processing seemed to be facilitated and that films had a dry "handle." The effect of activated oxides of the type described on polyisobutylene was incomparably greater than of non-active oxides having the same chemical composition. With the possibility of inhibiting plastic flow, many new applications are seen for polyisobutylene in which its excellent chemical resistance, aging qualities, and dielectric properties can have fuller play.

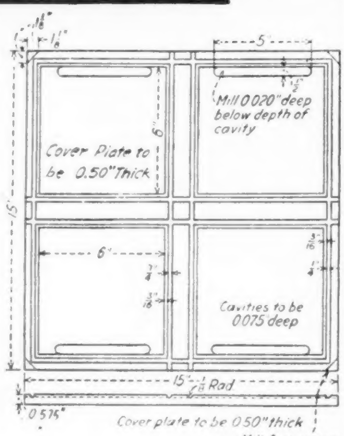
[1] *Kunststoffe*, 44, 3, 103 (1954).

SPAIN

Government Encourages Production and Export of Rubber Goods

For some years, the Spanish Government has been actively promoting a sound domestic rubber industry by taking steps to improve both quantity and quality of production of rubber manufactures and by backing experiments aiming at the development of raw rubber sources within its own territories to insure availability of adequate supplies.

It launched the so-called Operation A.C. on May 7, 1951, with an executive committee to exercise strict supervision over the quality and the packing of rubber manufactures for export, except tires and tubes. As a result, Spanish rubber goods have been finding their way into various foreign markets, chiefly outside of Europe. A part of the foreign currency thus earned is retained by the government, and the balance must be used to import necessary equipment and raw materials for the industry and to pay for propaganda abroad. The effect of this measure is already seen in the up-to-date machinery of new establishments and recent extensions, and the modernization of many older establishments will no doubt also follow. Spain now has some 300 rubber manufacturing firms of various sizes, with a combined capital of more than 600,000,000 pesetas, which together



consume about 14,000 tons of rubber annually, employ about 25,000 persons, and produce practically every type of rubber goods required by the home market.

Attempts to provide raw rubber supplies seem to have first been undertaken in 1943 when experiments in growing guayule in different parts of Spain and also in Spanish Morocco were started. In Spain, the best results were obtained in the Province of Huelva, which now has about 200 hectares of experimental plantings. Eventually it is hoped to be able to grow enough guayule to yield some 1,000 tons of rubber annually, and a pilot plant for processing guayule is contemplated.

In 1947 a scheme for planting *Hevea* in Spanish Guinea was begun; the aim was eventually to have 20,000 hectares under *Hevea* with a yield of 7,000 tons annually, or half Spain's present needs. Up to now, progress appears to have been slow because of the lack of labor to clear and plant this considerable area, to say nothing of getting seed. Intensive studies are also being made to determine the optimum conditions for growing *Taraxacum Kok-saghyz* in Spain capable of giving satisfactory yields of rubber.

Research of a different type seems to be in progress on a cactus plant, the prickly pear, from which apparently it is expected to obtain raw material for making a synthetic rubber.

Spanish manufacturers, too, are interested in special-purpose synthetic rubbers, and a locally produced Thiokol-type rubber recently appeared on the market, it is reported. Elastron, as it is called, is a polyethylene sulfide formed by the reaction of ethylene chloride with sodium polysulfide. It is available both as a solid and a latex, has exceptional resistance to most organic solvents and chemicals, and is used chiefly for packings, hose for oil, acids, and gasoline, and also as a substitute for lead sheathing in the cable industry, it is claimed.

FRANCE

Le Bras Chapter on Natural Rubber Chemistry

J. Le Bras, director of research of the Institut Français du Caoutchouc, Paris, is the author of a chapter, "Chemistry of Natural Rubber," in a book, "Traite de Chimie Organique," Volume XXII, published under the direction of Profs. V. Grignard, G. DuPont, and R. Loquin, by Masson et Cie, Paris, 1953.

Dr. Le Bras outlines the fundamentals of our present knowledge of rubber as completely as possible in the space available to him. The history of rubber, the chief latex bearing plants, latex systems, and methods of exploitation are explained, followed by the latest findings on composition, structure and properties of fresh latex and raw rubber, the rubber hydrocarbon, its chemical properties and reactions.

Also discussed are the principles involved in the processing and curing of rubber and the views of various investigators on the phenomenon and theory of vulcanization. The concluding pages of the chapter deal with the physical properties of rubber, with special reference to theories on the amorphous and crystalline structure of rubber, flow mechanics, elasticity of rubber, and swelling by liquids.

UNION OF SOUTH AFRICA

South Africa is now in a position to cover most of the local demand for tires, tubes, and mechanical and industrial goods, recent government reports reveal. In fact the Union is developing a good export market in near-by territories, particularly for tires and tubes. In Kenya, for instance, business has been increasing steadily in spite of the unrest, and in 1953 the Union sent rubber manufactures to a value of £1,250,000; it supplied about 50% of the Kenya demand for tires.

The greater activity of the industry is reflected as much in the heavier imports of crude rubber, which averaged 2,600 tons a month in 1953, against 1,900 tons in 1952, as in the favorable business reports of some of the leading rubber manufacturers. Dunlop booked profits of £523,198, against £305,032 the year before, and increased the ordinary dividend from 12 to 15%; Goodyear's net profit was £326,829, against £276,360, and a dividend

(Continued on page 291)

New Machinery

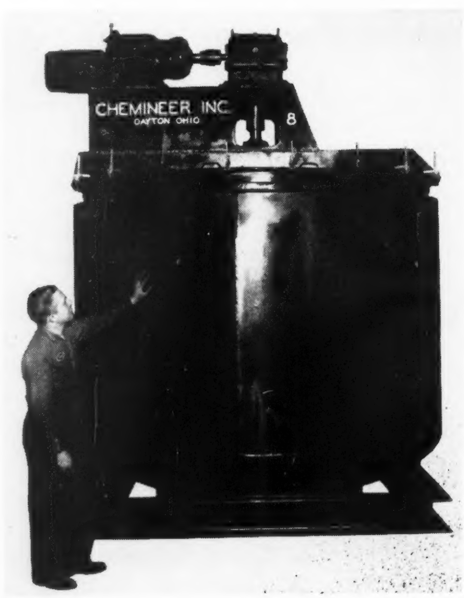
65-Pound Silicone Spray Tank

65-Pound IMS Silicone Spray Aerosol Tank

A 65-POUND Silicone Spray Aerosol tank for full automatic molding where a periodic application of mold release is needed, or for molding operations in which use of individual dispensers is uneconomical, has been developed by Injection Molders Supply Co., 3514 Lee Rd., Cleveland 20, O.

The unit, complete with hose and spray gun, allows ready adjustment both of the amount of spray and of the spray pattern, the company reports. In automatic molding, the gun is dismantled and utilized in conjunction with limit switches or timers to permit periodic application without operator attention.

The separate tanks are returnable for recharging, but remain the property of the molder. The Silicone Spray formulation is the same as that used in the firm's Aerosol Bombs.



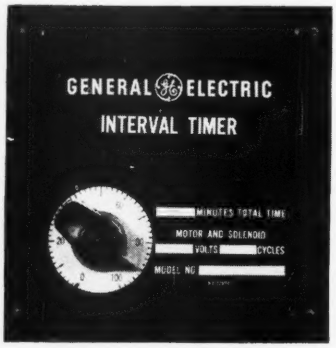
Chemineer Latex Processing Unit

Latex Mixing Vessel

LATEX processing units of 2,000-gallon capacity are being introduced to the rubber industry by Chemineer, Inc., Dayton, O. Equipped with a hinged lid section with quick-action clamps to facilitate loading, the mixing vessels contain turbine impellers for high circulating capacity and minimum shear. The interior is made of stainless steel. The agitator is driven by a variable speed mechanism.

A ventilation nozzle and thermowell are housed in the stationary section of the lid. Heating and cooling of the batch are accomplished by a full jacket equipped with circulating baffles.

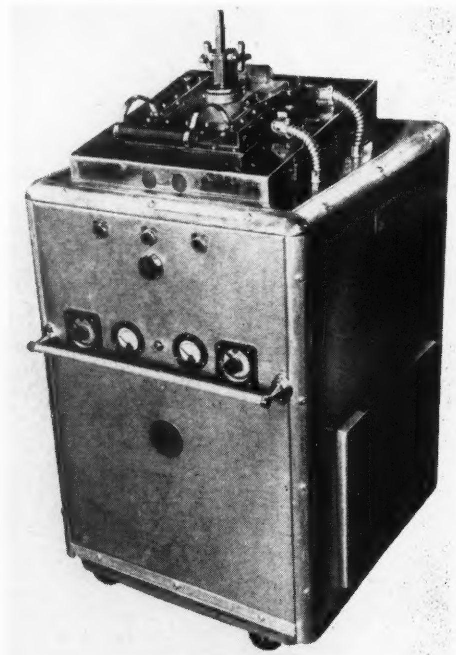
Process Timer



Front View of G-E Interval Timer

A PROCESS timer for use with such industrial machinery as molding presses and automatic mixers has been announced by General Electric Co., Schenectady, N. Y. Designated TSA-21, the 6¾-pound instrument is also said to be applicable to power distribution equipment where precision control for starting automatic substation equipment and reclosing automatic circuit breakers is required.

Featuring one-knob control, and calibrated from 0-100%, the timer consists of one set of time-opening main contacts and one set of electrically separate time-closing main contacts. Each timer has a set of instantaneous contacts which can be used independently or as hold contacts for the timer solenoid.



Resdel's Model 5000 Dielectric Heater

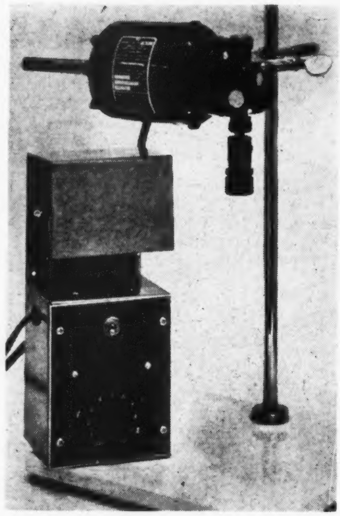
Dielectric Heater

THE Model 5000 "Electronheat" dielectric heater, a new machine from Resdel Engineering Corp., Los Angeles, Calif., is now available for use on production lines for molding, extruding, drying, etc., of rubber and plastic products. Capable of a full five-kilowatt output, the heater features double shielded cabinets which reduce radiation far below the minimum required by the Federal Communications Commission, according to the Resdel company.

Model 5000 is a portable heater, constructed of the standard heavy-duty parts. It can accommodate a maximum compound capacity of six pounds and is reported to be able to raise the temperature of four pounds of phenolic material from 80 to 240° F. in one minute. The machine is housed in an aluminum cabinet and has overall dimensions of 48 inches high by 28¼ inches wide by 30¼ inches deep. Other specifications given by Resdel include: electrode size, nine by nine inches; electrode opening, ¾-3½ inches; two timers, 0-3 minutes; and power requirements, three-phase, 60-cycle, 230 volts (30 amperes) or 460 volts (15 amperes).


You Will Want THIS BOOK
Mechanical Goods PRESSES
ERIE
ERIE
FOUNDRY CO.,
ERIE, PA., U.S.A.
Bulletin No. 350
HYDRAULIC PRESSES
Erie Foundry
HYDRAULIC PRESSES
For Rubber Working
Multiple Opening Platen
Self-Contained Forming
Mechanical Goods Presses
Extrusion Presses
Special Purpose Presses
Abrasive Molding
Die Hobbing Presses
Light Precision Molding
Presses for Diverse Applications
Write for Your
Copy of Bulletin 350
ERIE
FOUNDRY COMPANY
HYDRAULIC PRESSES
ERIE FOUNDRY COMPANY • Erie, Pa., U.S.A.
DETROIT
335 Curtis Building
CHICAGO
13 South Austin Blvd.
INDIANAPOLIS
2302 N. Meridian Street
NEW ENGLAND
G. V. Eads, Kent, Conn.

Ace Electronic Lab Stirrer

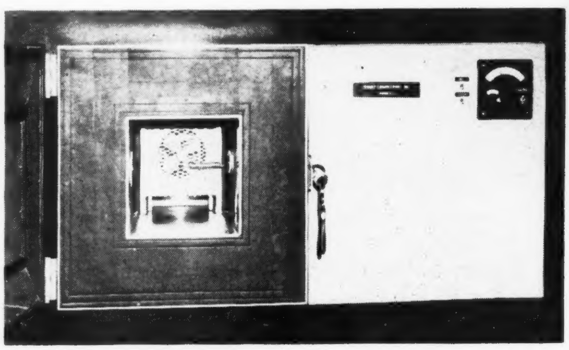


Ace Electronic Laboratory Stirrer

AN ELECTRONICALLY controlled adjustable speed laboratory stirrer has been introduced by Ace Glass Inc., Vineland, N. J. No. 3650 in the company's catalog, the stirrer has a series wound DC ball-bearing gearhead motor, with the direct drive and gear drive shafts both extended and usable; the motor is driven by a phase-shift thyratron tube controlled rectifier which converts the alternating current of the mains to direct current.

The DC motor is said to supply adequate power at low speeds in contrast to AC motors which lose power as voltage is reduced for slow-speed stirring. Another advantage is reported to be a diminished tendency to heat up at low voltage. The motor is 1/50-hp., fully enclosed and having its field and armature fed by two-2050 rectifier tubes.

The speed on the direct drive shaft is about 400 to 4000 rpm. in stepless control, and the speed of the gear-driven shaft is 1/18 of the direct or armature speed. Other released data show the starting torque on the armature shaft to be 32 inch-ounces, with an estimated safe load on the slow-speed shaft of no more than five inch-pounds for maximum life of the worm and gear drive. The motor may be run in either direction.



Tenney Low-Temperature Test Chamber

Table-Model Test Chamber

A SELF-CONTAINED low-temperature test chamber that measures 29½ by 57 by 30½ inches (height by length by width, respectively) and weighs 450 pounds has been developed by Tenney Engineering, Inc., Union, N. J. Temperatures as low as —100° F. and as high as 212° F. can be attained by the unit, according to the company.

The cascade system of refrigeration is used to remove heat (as much as 1,000 btu per hour at —80° F.). This system embodies two interlinked refrigeration circuits wherein the evaporator of one is the cooling element of the condenser of the second. Freon 22 is the refrigerant used in the first stage circuit, while Freon 13 is used in the second stage circuit. Feature of the chamber is the arrangement of the refrigeration tubing in a circle around the one-square-foot work space both to conserve space and achieve more uniform temperature distribution within the space.

Heating is accomplished by non-glowing, low surface-temperature heaters in the rear of the chamber. Air is circulated within the stainless-steel lined chamber by a fan.

Other features of the device include: a 2½-inch port which enables wire leads to be brought into the chamber; automatic controls to maintain the set temperature within ±2° F.; and a thermobulb located inside the chamber and connecting with a temperature indicating instrument on the front of the unit.

New Materials

Electrical Vinyl Resin—Pliovic EDB90V

AN electrical-grade polyvinyl chloride resin, said to be fully interchangeable with all other electrical PVC's, has been introduced by Goodyear Tire & Rubber Co.'s chemical division, Akron 16, O. Called Pliovic EDB90V, the resin is reported to be applicable to the manufacture of primary insulations for building and industrial wire, cable jacketing, flexible cord, and fixture and appliance wire insulations.

According to Goodyear, the resin has been approved by Underwriters' Laboratories and is outstanding for its ability to dry blend readily into a free-flowing mix for extrusion and calendering operations. Specifications on the new material have been reported as follows:

Color	**white**
Size distribution, through 40 mesh, %	**100**
80 mesh, %	**90-100**
200 mesh, %	**0-20**
Intrinsic viscosity	**0.89**
Specific gravity	**1.40**
Volume resistivity, ohm cm.	**2×10^{15}**
Power factor @ 1000 cps. & 30° C.	**0.095**
Dielectric constant @ 1000 cps. & 30° C.	**6.7**
Strength, volts/mil	**500**

Technical bulletin PVR-100-8 on this material is available from the company.

Silicone Rubber Cable Insulation—SE-965

A SILICONE rubber that requires no milling and is primarily intended for cable insulation has been introduced by General Electric Co., Pittsfield, Mass. Designated SE-965, the new rubber is said to be low in cost compared to most silicone rubber compounds, can be fed with ease into extruding equipment, and needs no oven baking.

Other advantages claimed for the material are excellent shelf stability, good electrical properties, and facility of braiding. According to GE, this material can be tinted in various colors, and is suitable for Navy cable as well as for general commercial applications for heat service up to 150° C.

Some physical and electrical properties of the rubber have been reported as follows:

Oven cure	One Hr./ 300° F.	24 Hrs./ 300° F.
Specific gravity	1.50	1.50
Hardness, Shore A	60 ± 5	70 ± 5
Tensile strength, psi.		
Typical	650	800
Minimum	600	700
Linear shrinkage, % (ASTM slab)	4	4
Coefficient of thermal expansion	0.000150 in./in/° C.	
Temperature range	25-250° C.	
Volume resistivity, ohm-cm.*	1.5×10^{15}	
Dielectric strength, volts/mil.*	450	
Constant (60 cps.)*	3.6	
Power factor (60 cps.)*	0.0040	

*24 hrs. oven cure at 300° F.

A technical bulletin describing SE-965 may be obtained from the company on request.

Primary Phthalate Plasticizer—Santicizer 603

SANTICIZER 603 (butyl decyl phthalate), a primary phthalate plasticizer intended as a companion product for Santicizer 160, has been introduced for commercial use by Monsanto Chemical Co., St. Louis, Mo. The major application of this new material, according to the company, will be in the compounding of polyvinyl chloride and vinyl chloride copolymers.

Applicable to film, sheeting, plastisols, and extrusions, Santicizer 603 is said to impart low-temperature flexibility, greater plastisol viscosity stability, and slower fusion or solvent action to vinyl compounds.

Mapico Colors—Brown 422, Tan 15

TWO new colors for use in rubber compounding, Mapico Brown 422 and Mapico Tan 15, have been introduced by Binney & Smith, Inc., New York, N. Y. Their specifications, as reported by the company, are as follows:

	Mapico Brown 422	Mapico Tan 15
Iron oxides, %	98.00	99.00
Fe°	trace	—
Ignition loss, %	1.02	None
Moisture, %	0.44	0.07
Water soluble, %	0.32	0.045
Acid insoluble, %	0.27	0.19
pH (10 gm. in 150 ml. distilled water)	7.10	5.30
Oil absorption (Gardner-Coleman)	24-28 lbs./100 lbs. of color	31.35 lbs./100 lbs. of color
Specific gravity	4.70	5.24

Mapico 15 is said to be a bright, easily dispersed tan color that has been found to give natural rubber, GR-S, and Neoprene GN compounds with excellent aging properties.

Mapico Brown 422 is a lighter brown that extends the color range of the Mapico Brown series.

Dow Corning 410 Gum

RUBBERY parts with properties intermediate between those of silicone rubber and organic rubbers can be produced by compounding with Dow Corning 410 Gum, a new silicone polymer, according to its manufacturer, Dow Corning Corp., Midland, Mich. The polymer can be vulcanized with sulfur and blended in any proportion with organic rubbers, or it can be applied as a protective coating.

Serviceable temperature limits and weather resistance of the rubber are thus extended, Dow Corning says, with brittle points in the range of —70° F. and usefulness at temperatures up to 400° F. being realized by proper blending. The physical properties of the blend will adjust between those of high-strength silicone rubber and the organic rubber component.

Blended with oil resistant rubbers, Dow Corning 410 Gum is said to improve their stability in hot oil. Ozone resistance is also reported to be markedly increased; a 50-50 blend of nitrile type rubber and the silicone polymer exhibited no cracks after more than eight hours in an ozone atmosphere; while pure nitrile rubber showed flaws after 30 minutes.

Samples of Dow Corning 410 Gum may be obtained from the company on request, as can a publication describing its properties and giving compounding suggestions, Reference 1-202 of "Silicone Notes."

Epoxy Resin Adhesive—Amphesive 801

A GENERAL-PURPOSE adhesive said to be capable of achieving shear and tensile strengths greater than 3000 psi. has been introduced by Atlas Mineral Products Co., Mertztown, Pa. Called Amphesive 801, it consists of epoxy resin and catalyst, mixed at the time of use, and is recommended for bonding such materials as glass, metals, concrete, ceramics, wood, plastics, reinforced polyesters, and nylon. It will not adhere to polyethylene, Teflon, or Kel-F.

The adhesive is reported to have very low shrinkage upon setting and can be used as a void filler or potting compound. Adhesion time is said to be 24 hours at 77° F. and one hour at 190° F.

Silicone Rubber Gums—#81465, #81477

TWO new silicone rubber gums with an alleged strength twice that of hitherto available silicone rubber have been introduced by General Electric Co., Pittsfield, Mass. Known as #81465 and #81477, the polymers were designed to be compounded with a newly developed du Pont silica filler.

A tensile strength of nearly 1600 psi. is claimed for the silicones, as well as a 50% increase in elongation capability. No. 81465 is said to possess normal shrinkage and flexibility at —650° F.; while #81477 shows lower shrinkage and retains flexibility below —100° F. and is particularly suited to aircraft use.

The gums are reported to be commercially available, but are still undergoing developmental work in relation to their compounding with the silica filler.

Unsaturated Diesters for Polymerization—DIOF, DOF, DIOM, DOM

FOUR unsaturated diesters for use as comonomers in polymerization reactions have been made available by Rubber Corp. of America, New South Rd., Hicksville, N. Y. They are: di-iso-octyl fumarate (DIOF); di-2 ethylhexyl fumarate (DOF); di-iso-octyl maleate (DIOM); and di-2 ethylhexyl maleate (DOM).

Said to be compatible with most synthetic and natural resins and rubbers with the exception of water soluble polymers, the octyl fumarates are described as being clear in color and having a low viscosity and acidity. Internal plasticization can be built into special tailor-made polymers with them, the company states.

The octyl maleates are isomers of the similar octyl fumarates and, when copolymerized with other monomers, produce polymers with interesting optical and electrical properties, according to the company. Both esters are reported to be stable liquids of high purity. Like the fumarates, the maleates are of clear color and of low viscosity.

Some reported properties of the materials are as follows:

	DOF	DIOF	DOM	DIOM
Specific gravity, 20/20° C.	0.942 ± 0.002	0.942 ± 0.002	0.944 ± 0.002	0.944 ± 0.002
Moisture, %, maximum	0.05	0.05	0.05	0.05
Flash point, °F	365	375	360	360
Gel point, °C	−50	−50	−50	−50
Viscosity, cps., at 25° C.	20	20	21	21
Surface tension, dyns/cm., 25° C.	32	33	31	31
Weight/gal. at 20° C.	7.84	7.84	7.87	7.87
% Solubility, in water at 25° C.	0.01	0.02	0.02	0.02
Water solubility in, at 25° C.	0.15	0.10	0.12	0.15

Secondary Plasticizer—Elastex 40-P

A LOW-COST, near-colorless secondary plasticizer has been introduced by Barrett Division of Allied Chemical & Dye Corp., New York, N. Y. Called Elastex 40-P, the ester is said to provide good efficiency, heat and light stability, and low-temperature performance.

According to the company, the material can also be used as the sole softening agent in formulations for which low cost rather than low volatility is the primary consideration. Another application is the formulation of plastisols and organosols.

Some typical properties of Elastex 40-P plasticizer (butyl iso decyl phthalate) have been reported as follows:

Odor	mild, characteristic
Color, Hazen, max.	50.0
Molecular weight (theoretical)	362.5
Specific gravity @ 20/20° C.	0.997
Viscosity, cps. @ 25° C.	38.0
Refractive index	1.490
Flash point, °F., open cup (ASTM D92/52)	393
Acidity (as phthalic acid), wt. % max.	0.01
Saponification no.	310
Pounds/gal. @ 68° F.	8.1

A technical data report on the plasticizer may be obtained from the company on request.

Finish for Plastic Sheeting—Logoquant R-102

A NEW finish, Logoquant R-102, particularly recommended by the manufacturer for spray application to high impact polystyrene sheet prior to vacuum forming, is now available from Logo, Inc., Chicago, Ill. The new material may also be used on acrylic butyrate and rigid vinyl sheeting prior to vacuum forming operations.

Logoquant R-102, available in an unlimited range of pigmented colors, completes a series of these materials developed for each vacuum forming plastic sheet, whether requirements demand spray or silk-screen application. R-102 is described in the company's data sheet as a clear liquid (no suspended particles) which dries to a colorless film having good adhesion, gloss, and drawing extensibility. The humidity, stain, and soap and detergent resistance, accelerated aging characteristics, and other properties of the film are also given in the publication of September '54.

olymeri-
Corp. of
di-iso-
DOF);
maleate

l resins
ers, the
having
be built
r states,
marates
e poly-
cording
liquids
of clear

ollows:

DIOM
0.944±
0.002
0.05
60
50
21
31
7.87
0.02
0.15

er has
nical &
ester is
y, and

e used
h low
ration.
s and

(butyl

cteristic
50.0
362.5
0.997
38.0
1.490
393
0.01
310
8.1

tained

102

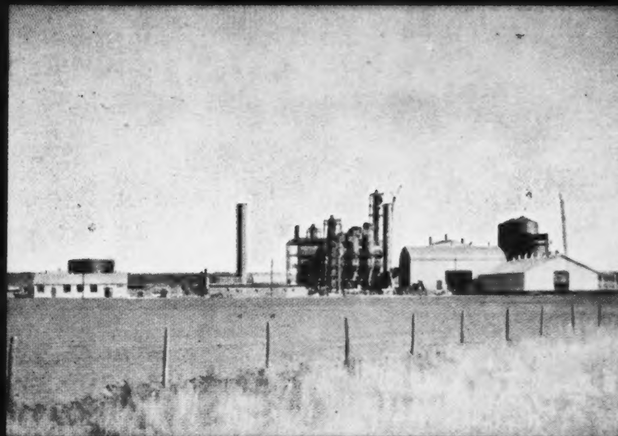
nended
impact
ailable
lso be
acuum

mented
r each
l spray
pany's
which
draw-
ergent
perties
er '54.

W

unice,

5 MODERN WITCO-CONTINENTAL PLANTS...

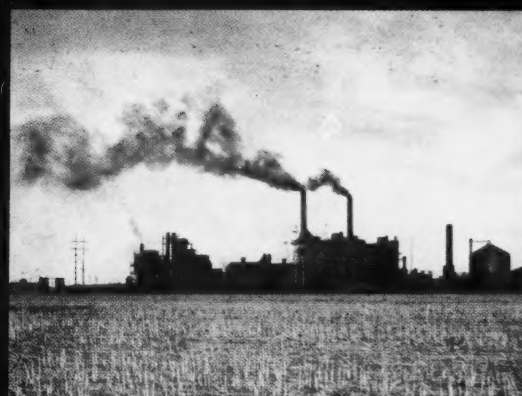


Ponca City, Oklahoma—our newest plant

Five good reasons why you can depend on

WITCO-CONTINENTAL CARBON BLACKS

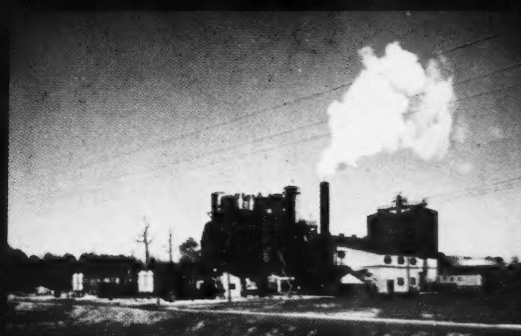
always uniform . . . always dependable



Sunray, Texas

Producing a complete line of carbon blacks under strictest quality controls to fulfill your most rigorous requirements.

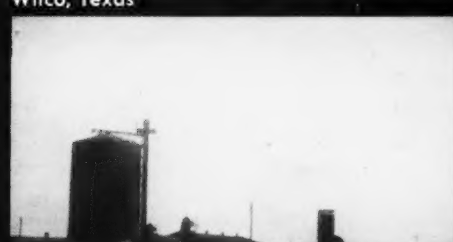
Check your needs against Witco-Continental's Channel and Furnace Blacks listed on the next page . . . •



Westlake, Louisiana

unice, New Mexico

Witco, Texas



KS

No. 12
No. 1
6

cing
g

NY

uston
gland

A
at
stan
bina
duce
rich
Safe
to i
safe
Life
prem
cept
The
for
and
Ac
pany
that
itsel
blow
capit
In a
skid
as w
squea
abou
desig

A I
i
Rubb
the A
featu
its sp
of co
A v
as gr
be wi
Equip
tained

A I
ammo
an inc
in ag
of U.
hose
pressu
there
Wo
The h
tube t
is of
vapors
in dia

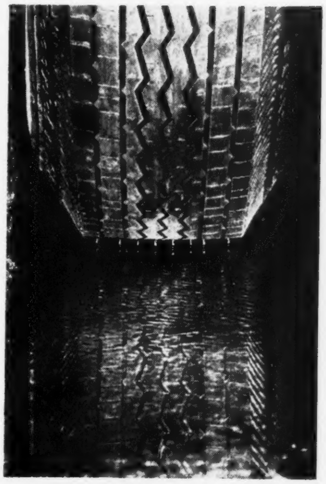
A W
ou
forced
Europ
piece
lead a
The
technic
found
includi
service
labora
carbon

New Goods

Safetyliner Tubeless Tire

A NEW tubeless tire, reported to be offered at the same price as a standard tire and tube combination, has been introduced by The B. F. Goodrich Co., Akron, O. Called Safetyliner, the tire is said to incorporate many of the safety features of the firm's Life-Saver tubeless tire, its premium counterpart, except for puncture-sealing. The new tire is intended for both original equipment and for replacement use.

According to the company, a patented inner liner that is part of the tire itself eliminates dangerous blowouts by reducing escaping air to a minimum. In addition, maximum nonskid and traction qualities, as well as a minimum of squeal, have been brought about by the new tread design of the tire.



Tread Design of New Goodrich Safetyliner Tubeless Tire

Flexible Oil Hose

A LIGHTWEIGHT, flexible hose for use in transferring oil in dockside operations has been developed by United States Rubber Co., Rockefeller Center, New York 20, N. Y. Called the Amazon Oil Discharge Hose (H-1515), the new product features the use of lightweight steel nipples, which combined with its special construction, results in a unit weighing one-third that of conventional hose, according to the manufacturer.

A working pressure of 200 psi., with a safety factor five times as great, is claimed for the hose. Bending and kinking can also be withstood by the product without damage, the company reports. Equipped with a neoprene tube and cover, H-1515 can be obtained in sizes ranging from 3-12 inches inside diameter.

U. S. Agra Ammonia Hose

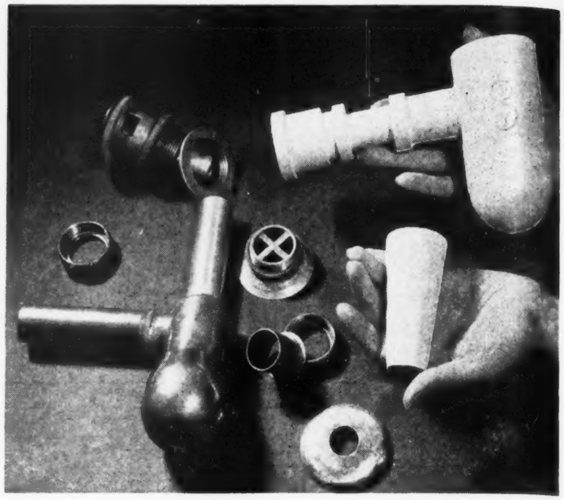
A hose that can withstand the low temperatures caused by ammonia vaporization has been developed to meet the needs of an increasing use of hazardous anhydrous ammonia as a fertilizer in agriculture. Manufactured by the mechanical goods division of U. S. Rubber, Rockefeller Center, New York 20, N. Y., the hose is intended for use in the transfer of ammonia under pressure from bulk storage tanks to dispensing units and from there to the soil several inches below the surface.

Working pressure of the hose is 400 pounds per square inch. The hose is reinforced with wire braid and has a synthetic rubber tube that is resistant to oil and low temperatures. The cover is of neoprene, perforated to allow safe dissipation of ammonia vapors. Called U. S. Agra Wire Braid Ammonia Hose, it comes in diameters of ½-inch to 1½ inches.

Rubber Drainpipe Marketed in Europe

A WHITE rubber drainpipe that can be easily installed without tools and is sufficiently pliant to enable materials to be forced out of a clogged drain is reportedly being marketed in Europe by an Austrian concern. Trade marked Gisy, the two-piece unit is said to cost only a fourth as much as traditional lead and brass systems and lasts almost as long.

The drainpipe has been tested at the Vienna Federal Polytechnical Institute, according to the manufacturer, and has been found to be leakproof and resistant to most liquids under 200° F., including acids and alkalies. It is said to be giving satisfactory service in many Austrian homes and hospitals, and even in laboratories, except where rubber dissolving reagents such as carbon tetrachloride are used.

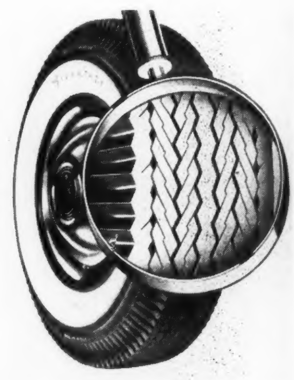


Gisy Rubber Drainpipe to Replace Metal Counterpart

The inner piece of the unit is a conical cylinder designed as an odor lock against the disposal pipe in the wall. The outer piece is the trap and connecting arm and is attached to the wall outlet. Softening the rims of the pieces with soap and warm water makes manual installation a relatively simple affair, the company says. Clogging materials can generally be forced out of the pipe by squeezing the trap.

The Austrian inventor of the Gisy unit holds a number of European patents, and his United States patents are pending. He is seeking an American firm to manufacture his product here.

Transport B-112 Heavy Duty Truck Tire



Firestone DeLuxe Champion Tubeless Tire

Low-Cost Truck Tire

TRANSPORT B-112 HEAVY DUTY, a new low-cost truck tire that reportedly incorporates the latest improvements in tire design and performance, has been introduced by The Firestone Tire & Rubber Co., Akron, O. Fabricated with rib-type tread and tension-dried, gum-dipped cord, the new tire has non-skid traction and strength greater than other competitively priced tires, the company claims, and may be recapped safely and economically many times.

The tire has the same quality tread rubber, tread depth and size as original equipment tires, and is being manufactured in sizes 6:00x16 through 10:00x22, Firestone adds.

New Tread Design for Tubeless Tire

A tubeless tire featuring a new tread design said to provide added safety and quieter performance also comes from the Firestone company. Called Firestone DeLuxe Champion, the tire is edged with small Z-shaped tread segments which move independently of each other, conforming to road irregularities. Outstanding safety feature of the new tread design is the

inclusion of 70% more ingeniously arranged skid resistors, resulting in greatly increased traction and car control. By varying the distance between tread design elements, the company feels that noise of the tire on straight runs and in cornering has been silenced.

Newly developed tread rubber compounds and new rayon tire cord fabrics result in 25 to 30% more strength than in comparable tires now standard equipment on automobiles, it was said.

Waste Retainer for Freight-Car Journals

Plypak Retainer *(Foreground)* and Journal Box

PLYPAK, a new Hycar rubber waste container and retainer for use with freight-car journals, is being manufactured by Davidson Rubber Co., Boston, Mass. Primary advantage of the device is that it greatly reduces the number of lubrication failures which are the cause of about 70% of the overheated journals, commonly called hot boxes, according to the company.

Freight-car journals are lubricated by oil-saturated wool or cotton waste packed beneath the journal in the journal box. This waste has a tendency to work up around the journal and under the bearings to cut off lubrication and cause overheating. After a time the overheated journal and bearings break, necessitating expensive repairs. Plypaks are molded with comb-like projections which fit against the journal to prevent movement of the waste. The units also contain holes through which waste protrudes to act as wicks to keep the waste saturated; the holes also permit dirt to settle to the box below the Plypak.

Tests have demonstrated a reduction in the number of hot box occurrences by as much as 75% through use of the device. It is also believed that use of the Plypaks, already approved by the Association of American Railroads, can extend the journal repacking period from the present 18 months to three years.

Container Sealing Tape

A WATER-RESISTANT, high-strength sealing tape for cartons, paper tube ends, and bundles was introduced to the market recently by Permacel Tape Corp., New Brunswick, N. J. Paper-backed and specially impregnated with a waterproof rubber resin composition, the new tape, known as P17, is designed to withstand extremely rough handling in shipment under both wet and dry conditions. A rubber-type pressure-sensitive compound is used as adhesive.

P17 has the advantage of requiring no activating solvent, as is required by gummed kraft paper, according to the company. Federal specifications permit its use in two-inch strips to replace three-inch wide gummed kraft tape. Rolls 120 yards long and from 1/4-12 inches wide can be supplied at present.

Wide Hycar Rubber Squeegees

EXCEPTIONALLY wide rubber squeegees, in sizes of 25, 35, or 45 inches, have been introduced by Daugherty Rubber Co., Cleveland, O. Made from Hycar American rubber, a B. F. Goodrich Chemical Co. product, the blade is said to be resistant to oils, soap, and other materials commonly found on floors of industrial and business sites.

Fastened to a wooden handle by a welded steel brace, the squeegee blade is curved to prevent dirt and water from spilling around the ends. It is said to be tough and long-lasting. The Corson Rubber Products, Inc., North Barberton, O., prepares the Hycar stock from which the blade is molded.

Editor's Book Table

BOOK REVIEWS

"Adhesive Bonding of Metals." George Epstein. Reinhold Publishing Corp., 330 W. 42nd St., New York 36, N. Y. Cloth, 4½ by 7 inches, 226 pages. Price, $2.95.

Among the topics covered by the author, an aviation research engineer, are the physical and chemical properties of adhesives, their formulation, properties of cured adhesive bonds, the various factors affecting the strength of these bonds, and the details of sandwich construction. The appendices include mechanical properties of eight structural adhesives for metals, and selected references.

"Statistical Analysis in Chemistry and the Chemical Industry." Carl A. Bennett and Norman L. Franklin. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Cloth, 6 by 9 inches, 740 pages. Price, $8.00.

Commissioned by the Committee on Applied Mathematical Statistics of the National Research Council, this book represents a definitive treatment of a subject which in recent years has attracted widespread interest, particularly on the part of industrial chemists. The authors have given the theoretical background and derivation of the analytical methods, together with computational procedures, and have included enough of the mathematical theory underlying these methods to construct a basis for judging the soundness of their application. Also contained in this work are many revealing examples of statistical application taken from diverse chemical industries.

"Manual for Plastic Welding. Volume II—Polyethylene." G. Haim and J. A. Neumann. The Industrial Book Co., 1240 Ontario St., Cleveland 13, O. Cloth, 5½ by 9 inches, 140 pages. Price, $6.00.

This manual, one in a series devoted to the techniques of the welding of plastics, limits itself to the methods of gas welding of thermoplastic materials and is primarily intended as a guide for the practical welder. Theory is included, but on a relatively lay level. The various applications of thermoplastics in industry are also included. The book is extensively illustrated and contains many valuable appendices.

NEW PUBLICATIONS

"Fatty Acids in Modern Industry." A. Gross & Co., New York, N.Y. 24 pages. This catalog reports on the specifications, grades, packing, and stock points of the company's distilled stearic, oleic, coconut, cotton seed, soya, and palm fatty acids, and of glycerine, pitch, and hydrogenated tallow fatty acids.

"Retarder TCM-25." Technical Bulletin No. 1. Binney & Smith, Inc., 380 Madison Ave., New York 17, N. Y. 5 pages. The chemical and the physical properties of this retarder and suggested formulations with GR-S 1500 and natural rubber are contained in this bulletin. Also reported are the results of Mooney scorch tests and cures at various times and temperatures.

"The Toxicology of Acrylonitrile." American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y. 16 pages. Containing abstracts of experimental data gleaned from literature and the company files, this booklet reaches the conclusion that although acrylonitrile is toxic by ingestion, absorption through the skin, and inhalation, it is not so injurious as hitherto supposed.

"Research in Catalysis." Battelle Memorial Institute, Columbus, O. 4 pages. An outline of the services offered by this non-profit foundation and examples of how its research studies in catalysis and surface chemistry have aided manufacturers are given in this folder.

"Abstracts of Technical Papers from the Government Synthetic Rubber Program." Office of Synthetic Rubber, Federal Facilities Corp., Washington 25, D. C. $5 per set, paper covers. A four-volume compilation of abstracts covering papers published during 1942-1952 has been prepared by M. H. Forsythe and S. C. Wacker, of the Technical Publications Branch, Research & Development Division, Office of Synthetic Rubber, under the supervision of Paul S. Greer, chief of that Division. The assistance of Harry L. Fisher and Walter W. Rinne in reviewing the abstracts is acknowledged.

The volumes include a summary of synthetic rubber research work performed by the university, industrial, institute, and government groups participating in the synthetic rubber research program. Author and subject indices are included. Abstracts for the papers published during 1953 are currently being prepared, and issuance will be made in the near future.

"Thiokol Liquid Polymer/Epoxy Resin Adhesives." Thiokol Chemical Corp., Trenton, N. J. 16 pages. Typical starting formulations, properties, and methods of application of the firm's epoxy resin adhesives are contained in this booklet.

"Esters." Carbide & Carbon Chemicals Co., 30 E. 42nd St., New York 17, N. Y. 36 pages. This publication describes the company's complete line of esters and reports their physical and chemical data, uses, and applicable test methods. Of particular interest to the rubber and plastics fields are the non-volatile esters such as Flexol plasticizers DOP, 4GO, 3GH, and TOF, and the esters of maleic and acrylic acids which can be polymerized or copolymerized with other vinyl-type monomers to form resins and elastomers.

"Ectromag Magnetic Electrodes." Electronic Processes Corp., Los Altos, Calif. 2 pages. This bulletin describes the firm's newly developed unit for permitting the unobstructed high-frequency welding of large-area plastic sheets.

"Bibliography of Rubber Literature for 1946-1948." Division of Rubber Chemistry, American Chemical Society. Division treasurer—A. W. Oakleaf, Phillips Chemical Co., 318 Water St., Akron 8, O. Cloth, 6 by 9 inches, 484 pages. Price to non-members, $5. This eighth edition of the "Bibliography" brings the total coverage of the series to the period 1935-1948. The series is expected to be up to date by 1957, but even at this incomplete stage it continues to be of incalculable value to all technical men in the rubber field. The current edition contains more than 5,950 references to patents and literature, as compared with the 4,903 in the 1944-1945 volume. The general format remains the same: references are classified into groups, and brief abstracts appear for each; and comprehensive author and subject indices are included.

"Industrial Fire Hose and Fittings." Boston Woven Hose & Rubber Co., Boston, Mass. 8 pages. This illustrated catalog gives the specifications of the company's fire and suction hose, extinguisher tubing, and fire hose couplings.

"Symposium on Temperature Stability of Electrical Insulating Materials." Technical Publication No. 161. American Society for Testing Materials, Philadelphia, Pa. Paper cover, 6 by 9 inches, 136 pages. Price $2.75. This is a compilation of 11 papers and discussions originally presented at the fifty-seventh annual meeting of the ASTM, June, 1954, and concerns the latest heat testing methods on such electrical insulating materials as plastics, fabrics, mica, varnish, and silicone varnished glass fabrics. The text is complemented with abundant photographs, tables, and charts.

"Automatic Equipment for Handling Multi-Component Resin Mixes on a Production Basis." Applied Engineering Associates, Brooklyn, N. Y. 8 pages. The firm's continuous processing equipment for polyurethane foams and multi-component resins and elastomers such as epoxies, polyesters, polysulfides, and liquid phenolics are decribed in this booklet. Automatically controlled and suitable to conveyorized, large-scale operations, the machines are said to be adaptable to almost any combination of ingredients.

"Calibration Chart." Data Sheet No. 234. Pacific Transducer Corp., Los Angeles, Calif. 1 page. Intended for latex foam rubbers, sponge rubbers, and rubber-like plastic sponge, this free chart converts the various scales of the ASTM, RMA, Scott, and Shore A scales and the Pandux scale.

Publications of Phillips Chemical Co., Akron 8, O.:

"Philblack I Compared with Four Other Commercial ISAF Blacks in Natural Rubber." Bulletin No. 25. 4 pages. Superiority in heat buildup and resistance to abrasion are reported to be exhibited by Philblack I.

"Data on Polymers and Masterbatches Available from Office of Synthetic Rubber." Contained here are tables on the conversion of old to new code numbers, data on available polymers, and data on available masterbatches.

"Carbon Black—A Survey for Rubber Compounders." Bulletin P-10. M. L. Studebaker. 52 pages. This booklet presents information concerning the properties, processing, and compounding of carbon blacks and suggests lines of investigation for workers in the field of rubber compounding. Many performance charts illustrate the text.

Publications of E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del.:

"Neoprene Cellular Soles." BL-264, 8-30-54. 4 pages. This report discusses the compounding and processing of neoprene cellular soles, including both single- and double-cure methods.

"Practical, Water-Resistant Neoprene Compounds." BL-265, 8-31-54, 4 pages. This report covers the exceptionally water-resistant neoprene which results when red lead and the company's Thionex are employed in the curing process in place of magnesia.

"Neoprene Latex Adhesives." Report No. 54-3, September, 1954. R. W. Ward and F. W. Doherty. 54 pages. The chemical and physical properties, compounding, and applications of du Pont's neoprene latex adhesives are contained in this illustrated booklet.

"Neoprene Latex Treated Asbestos Papers," Bulletin PR-6, 9-15-54. The compounding methods and physical results of adding neoprene latex to asbestos slurries are contained in this publication. Such asbestos papers were found to have excellent resistance to swelling in water and oil, while the heat and flame resistance of the pure asbestos was only minimumly affected.

Publications of Monsanto Chemical Co., Springfield, M

"Cyanoethylation: The Chemical Modification of with Acrylonitrile." Technical Bulletin TX-14. 8 pa equipment and procedure for treating cotton fiber or fabr acrylonitrile to make the material resistant to mildew, bact and heat degradation, and to impart to it improved dyeing qualities, are discussed in this booklet.

"Lustrex Styrene Molding Compounds." 2 pages. This composite data sheet lists the mechanical, thermal, optical, physical, electrical, and molding properties of five Lustrex compounds.

"How to Pack and Ship Plastics to Save Money." 32 This illustrated booklet is the second in a series of p ing-problem studies relative to the plastics field and such subjects as selecting the proper container, prev damage in handling, warehousing, stacking, and lo and choosing a common carrier.

"HB-20 Extender Type Vinyl Plasticizer." Technical Bulletin No. O-P-153. 8 pages. This publication reports the results of tests conducted on HB-20. Excellent viscosity stability was found to be imparted to dioctyl phthalate plasticized plastisols. Initial viscosity build-up after four hours at 25° C. was reduced from 3220 to 2060 cps. by replacing 25% of the plasticizer system with HB-20. After 21 days the viscosity of the HB-20 and DOP formulation had increased to 4900 cps.; while that of the straight DOP rose to 9400 cps.

"Tuex and Ethyl Tuex." Compounding Research Report No. 31. Naugatuck Chemical Division of United States Rubber Co., Naugatuck, Conn. 12 pages. The performance of Tuex and Ethyl Tuex (tetra methylthiuram disulfide and its corresponding tetra ethyl body) as primary, secondary, and ultra-accelerators and as vulcanizing agents for natural, synthetic, and sponge rubber is covered in this publication.

"P-K Bulletin No. 13." Patterson-Kelley Co., Inc., East Stroudsburg, Pa. 12 pages. Photographs and specifications of the firm's blending, processing, and heat exchange equipment for the chemical and processing industries are contained in this publication.

"Bond Master Adhesives." Manual No. 110. Rubber & Asbestos Corp., Bloomfield, N. J. 12 pages. This illustrated folder pertains to adhesives for film, foil, and fabric and other web laminations and includes a master chart of adhesives for various laminating materials, and one reporting physical and chemical properties of the finished laminations.

Publications of the British Rubber Producers' Research Association, 48-52 Tewin Rd., Welwyn, Garden City, Herts, England:

"Departures of the Elastic Behavior of Rubbers in Simple Extension from the Kinetic Theory." Publication No. 193. 11 pages. This reprint from the *Transactions of the Faraday Society* discusses how the equilibrium stress-strain behavior of dry or lightly swollen rubber vulcanizates in simple extension departs from the predictions of the kinetic theory, contrary to highly swollen rubber which keeps in line with kinetic theory. These departures are herein described in terms of a single parameter C_2, of large magnitude in dry rubbers and decreasing to zero with degree of swelling. The value of C_2 is found to be independent of the nature of the rubber polymer, of the degree of vulcanization, and of the nature of the swelling liquid. In the light of this observation, the possible significance of this parameter is put forward.

"Vulcanization of Rubber by Organic Peroxides." Publication No. 194. 12 pages. This booklet reports the results of investigations to determine the kind of organic peroxides which meet the exacting requirement of the ideal peroxidic curing agent for rubber. Only di-tertiary butyl peroxide was found to give satisfactory vulcanization in black stocks. Pure gum vulcanizates of a high degree of transparency and good color were obtained with two commercially available non-hazardous peroxides which were also used successfully with some non-black fillers. The incorporation of resorcinol overcame a tendency to surface tackiness in peroxide cures and had a beneficial influence on tensile strength.

"Some Generalizations of the Shear Problem for Isotropic Incompressible Materials." Publication No. 195. 12 pages. This is a reprint from the "Proceedings of the Cambridge Philosophical Society".

"Molybdenum Products for the Chemical Process Industries." Bulletin Ch-1. Climax Molybdenum Co., New York, N. Y. 4 pages. The chemical properties of molybdenum, industrial uses, and the various molybdenum products available to the chemical industries are described in this publication.

"Properties of Molybdic Oxide." Bulletin Cdb-1. 4 pages. ... in a forthcoming series of molybdenum chemical data ...ns, this booklet, also from Climax, presents the chemical ...ical properties of molybdic oxide.

"All-Vision Chemical Cartridge Respirator." Bulletin No. 007-5. Mine Safety Appliances Co., Pittsburgh, Pa. 2 pages. The construction, use, and specific types available of the company's chemical respirator are contained in this bulletin.

"...aplex and Monoplex Plasticizers." Rohm & Haas Co., ...phia, Pa. 14 pages. The performance data, physical ...ies, and suggested uses of the company's six Paraplex ...ur Monoplex plasticizers are presented by means of graphs ...bles in this illustrated booklet.

"Rubber Material, Synthetic, Oil Resistant (Sheet, Strip, and Molded Shapes)." MIL-R-2765A. Department of the Navy, Bureau of Ships, Washington 25, D. C. 10 pages. This military specification covers synthetic rubber material for use as gaskets where resistance to oil and serviceability to temperatures down to —20° F. are required.

"Aluminum Building Wires and Connectors." Research Bulletin No. 48. Underwriters' Laboratories, Inc., Chicago, Ill. 45 pages. This publication reports the details of an inquiry conducted to obtain information on building wires employing aluminum instead of copper as the electrical conductor, and on solders and pressure wire connectors when used for making the joints in such conductors. The results of the test showed no damage to the aluminum conductors or to the insulation and coverings.

"Engineering Catalog." Bulletin 19-F. Dillon & Co., Inc., Van Nuys, Calif. 6 pages. Specifications and photographs of the firm's testing machines, pressure gages, thermometers, and scales are contained in this publication.

"Automobile Facts and Figures." 34th Edition, 1954. Automobile Manufacturers Association, Detroit, Mich. 80 pages. This publication is an almanac of information concerning the American automobile and its driver in 1954 and includes such details as the amount of automotive taxes ($6 billion), number of registered vehicles (58 million), gasoline consumption (42.7 billion gallons), and largest car export market (Mexico).

"How Dustube Collectors Cut Costs in the Manufacture of Rubber Goods." Bulletin 442. American Wheelabrator & Equipment Corp., Mishawaka, Ind. 4 pages. The operation of the company's cloth filtration dust collectors and their specific application by such rubber goods manufacturers as The Goodyear Tire & Rubber Co. and Brown Rubber Co. are described in this illustrated bulletin.

"Chemical Nature of Oil Extenders for Synthetic Rubbers." G. B. Report No. 8. F. S. Rostler and R. M. White. Golden Bear Oil Co., Los Angeles, Calif. 32 pages. This reprint from *Industrial and Engineering Chemistry* is a continuation of previous reports on the subject and suggests how the results of these investigations can be put to practical use in the standardization of oil extended rubbers.

"Rubber." August, 1954. Merrill Lynch, Pierce, Fenner & Beane, New York, N. Y. 6 pages. This folder by the well-known brokerage house is an appraisal of the natural and synthetic rubber situation both at home and abroad and is written with a particular eye on future prices. All the factors affecting supply and demand—production, consumption, world political events, the imminent sale of government-owned synthetic facilities, and expected technical developments—are discussed, and the price history of rubber since the Korean War is traced.

Publications of F. J. Stokes Machine Co., Philadelphia, Pa.

"A Truly Automatic Injection Molding Machine." Bulletin No. 560. 6 pages. The construction and operating data of the company's new Model 700 four-ounce unit are included in this illustrated folder.

"Vacuum Metallizing." Catalog No. 780. 20 pages. The company's vacuum metallizing process, the depositing of a thin coating of metal by evaporation and condensation under high vacuum conditions, is described in this illustrated booklet, together with typical applications to base materials such as plastic, metal, glass, paper, and textiles, and specifications of some of the firm's metallizing equipment.

"Glossary for the Protective Coatings Industry." Third Edition. L. J. Radi. R-B-H Dispersions, division of Interchemical Corp., Bound Brook, N. J. Hard cover, 4¼ by 7 inches, 140 pages. Price, $1. This alphabetized glossary defines chemicals, chemical and physical terms, and manufacturing processes as applied to the protective coatings industries.

Publications of Hercules Powder Co., Wilmington, Del.:

"Dresinate Emulsifiers, Detergents, Dispersants." 16 pages. The properties and typical formulations of the company's series of sodium and potassium salts of various processed rosins and tall oil, employed as emulsifying agents, detergent additives, dispersants, foaming and flotation agents, viscosity-control agents, and industrial sizing compounds, are contained in this illustrated booklet.

"Snythetic Resins, Pentaerythritol, Plasticizers, Nonionics." 8 pages. This publication gives a complete listing of the company's products in these categories and includes physical properties.

BIBLIOGRAPHY

Foamed Plastic Bandages for Medical Purposes. H. A. Schwab, *Kunststoffe*, 43, 1, 8 (1953).

Effect of Molecular Weight on the Properties of Polystyrene. H. R. Jacobi, *Kunststoffe*, 43, 1, 9 (1953).

Measurements of the Specific Heats of Various Plastics in Relation to Temperature. Th. Gast, *Kunststoffe*, 43, 1, 15 (1953).

Modern Insulation of Wires by Varnishing. A. Wiegandt, *Kunststoffe*, 43, 1, 19 (1953).

The Range of German Synthetic Resins. A Visit to the Plastics Exhibition, "Kunststoffe 1952," at Dusseldorf. E. Escales, *Kunststoffe*, 43, 2, 43 (1953).

Changes of Fatigue Resistance of Vulcanized Natural Rubbers during Swelling. V. E. Gul, T. V. Dorokhina, B. A. Dogadkin, *Rubber Chem. Tech.*, Jan.-Mar., 1953, p. 70.

Effect of Elongation on the Time of Relaxation T_2 of Natural Rubber. A. Cohen-Hadria, R. Gabillard, *Rubber Chem. Tech.*, Jan.-Mar., 1953, p. 78.

Investigation of Fractionated Polybutadienes by a Dynamic-Optical Method. V. N. Tzvetkov, A. I. Petrova, I. Y. Poddubny, *Rubber Chem. Tech.*, Jan.-Mar., 1953, p. 81.

The Role of Carbon Black in the Action of Light on Rubber. Y. S. Zuyev, *Rubber Chem. Tech.*, Jan.-Mar., 1953, p. 98.

New Urea Resins for the Paper Industry. A. Petz, *Kunststoffe*, 43, 3, 103 (1953).

Production of Films by Extrusion. A. Romanowski, *Kunststoffe*, 43, 4, 134 (1953).

Electric Metal Detectors in Processing Plastics. H. Schaffrath, *Kunststoffe*, 43, 4, 138 (1953).

Mold-Opening Force and Force of Ejection of Injection-Molded Cylindrical and Conical Objects. H. Gastrow, *Kunststoffe*, 43, 4, 140 (1953).

Identification of Resin and Filler Types in Laminates. E. Wandeberg, *Kunststoffe*, 43, 4, 165 (1953).

Synthetic Resins from Reactions of Active Methylene Groups with Aldehydes. H. Uelzmann, *Kunststoffe*, 43, 5, 175 (1953).

A Simple Method of Studying the Microscopic Texture of Crystalline Synthetic Resins and of Examining Such Opaque Substances for Non-Homogeneity. H. A. Stuart, U. Veiel, *Kunststoffe*, 43, 5, 179 (1953).

A New Rebound and Penetration Recorder for Packaging Films and Upholstery Materials. H. Klingelhoffer, *Kunststoffe*, 43, 5, 181 (1953).

Tin Ricinoleate—A New Light and Heat Stabilizer for PVC. F. Furter, *Kunststoffe*, 43, 5, 189 (1953).

The Martens Heat-Distortion Test for Plastics. C. M. v. Meysenbug, *Kunststoffe*, 43, 6, 214 (1953).

The New Wool-Like Fibers. D. Traill, *Rubber Age (London)*, May, 1953, p. 108.

Vinyl Synthetic Fibers. G. A. Powell, *Rubber Age (London)*, May, 1953, p. 121.

Where Do We Stand on Plastic Textiles? J. Campbell, *Modern Textiles*, June, 1953, p. 34.

Gums and Resins. C. R. Bragdon, *Paint, Oil, Chem. Rev.*, June 4, 1953, p. 26.

Selected Plastics References for the Mechanical Engineer, 1951-1952. A. K. Schmieder, H. G. Dikeman, *Mech. Eng.*, June, 1953, p. 477.

Sorption of GR-S Type of Polymer on Carbon Black. III. I. M. Kolthoff, R. G. Gutmacher, *Rubber Chem. Tech.*, Jan.-Mar., 1953, p. 102.

Ozone and Sunlight Effect on Aging of Carbon Black Vulcanizates. G. E. Pope, L. Harbison, *Rubber Chem. Tech.*, Jan.-Mar., 1953, p. 127.

Some Results Obtained in a Study of the Development of Stickiness by Vulcanized Rubber. L. Toullec, *Rubber Chem. Tech.*, Jan.-Mar., 1953, p. 136.

The Effect of Softeners in Rubber. I. Williams, *Rubber Chem. Tech.*, Jan.-Mar., 1953, p. 152.

Physical Properties of Natural and Synthetic Rubber Materials at Low Temperatures. J. Z. Lichtman, C. K. Chatten, *Rubber Chem. Tech.*, Jan.-Mar., 1953, p. 166.

Wear Resistance of Vulcanized Elastomers. J. C. Burns, E. B. Storey, *Rubber Chem. Tech.*, Jan.-Mar., 1953, p. 188.

A Tentative Explanation of the Weissenberg Effect in Latex Solutions. E. H. Frei, A. Katchalsky, *Rubber Chem. Tech.*, Jan.-Mar., 1953, p. 203.

South Africa

(*Continued from page 268*)

of 25% was paid on ordinary shares; while General Tire & Rubber reported profits up to £95,313 from £66,043, and raised the ordinary dividend from 3d. to 4½d. a share.

Dunlop is understood to be planning extensions to cost £2,000,000 to £3,000,000 in the next two years. Up-to-date plant, it is said, is to include electronically controlled machinery.

Smaller companies are taking up new lines. One firm in Johannesburg is now producing rubber-lined metal pipes and rubber-covered metal rolls; while a Natal company has acquired license to manufacture sectional curing bags for repairing pneumatic tires. Hitherto these bags had to be imported.

A rising demand is noted, moreover, for foam rubber, which is becoming very popular in furniture upholstery.

MARKET REVIEWS

RUBBER

Prices on both the spot and the futures market rose considerably during the period from September 16 to October 15, although trading was generally moderate. R.S.S. #1 moved to 27.25¢ a pound at the period's end, the highest price since May, 1953, and a gain of 2.8¢ over the period. Futures set life of contract highs, registering an average boost of 2.4¢ for the period.

Along with continuing political tension in the Far East, the catapulting of prices was believed to have resulted from persistent reports that the U.S.S.R. had negotiated with Indonesia for the purchase of 100,000 tons of crude rubber in all grades. European manufacturers were buying heavily from all sources, and observers reported that American purchasers had underestimated their future requirements.

In futures trading, near December stocks began the period at 24.50¢ and climbed with fluctuations to a seasonal high of 27.50¢ on October 15. Total sales during the second half of September were 7,530 tons, carrying the month's figure to 13,380 tons. In the first half of October, 7,550 tons were traded.

COMMODITY EXCHANGE
WEEK-END CLOSING PRICES

Futures	Aug. 21	Sept. 18	Sept. 25	Oct. 2	Oct. 9	Oct. 16
Sept.	23.34	....	....	....	....	....
Dec.	23.70	24.50	24.84	25.24	26.55	27.50
1955						
Mar.	23.80	24.62	25.00	25.30	26.30	27.05
May	23.85	24.70	25.00	25.30	26.30	26.90
July	23.90	24.77	25.05	25.30	26.35	26.75
Sept.	23.90	24.77	25.05	25.30	26.35	26.75
Dec.	....	24.77	25.05	25.30	26.35	26.75
Total weekly sales, tons	2,150	3,470	2,630	420	4,670	2,460

On the physical market, prices of all grades exhibited a rapid and consistent ascendency. R.S.S. #1, for example, began the period at 24.38¢ a pound and, except for September 20-23, rose steadily to a high of 27.25¢ on October 15.

September monthly average spot prices for certain grades were as follows: R.S.S. #1, 24.34¢; R.S.S. #3, 24.12¢; #3 Amber Blankets, 24.09¢; and Flat Bark, 20.34¢.

NEW YORK SPOT MARKET
WEEK-END CLOSING PRICES

	Aug. 21	Sept. 18	Sept. 25	Oct. 2	Oct. 9	Oct. 16
R. S. S.: #1	23.50	24.63	24.75	25.38	26.38	27.25
2	23.38	24.50	24.63	25.25	26.25	27.13
3	23.25	24.38	24.50	25.13	26.13	27.00
Latex Crepe						
#1 Thick	32.63	32.50	32.13	32.50	33.00	33.75
Thin	28.13	28.50	28.75	29.13	30.00	30.88
#3 Amber Blankets	23.88	24.25	24.50	25.00	25.88	26.88
Thin Brown Crepe	23.13	23.38	23.75	24.50	25.38	26.25
Flat Bark	19.50	20.38	20.63	21.00	22.00	22.88

Latex

Although the demand for natural latices duirng the period from September 16 to October 15 did not reach the higher levels predicted by observers, a renewal of interest was in evidence, possibly stimulated by persistent reports that the U.S.S.R. had negotiated a large contract for Indonesian rubber. Also, the recent rise in prices has been small compared to that of dry rubber. Current price range is from 32-34¢ a pound dry weight for natural latex.

Final July and preliminary August domestic statistics for natural and synthetic rubber latices follow:

(All Figures in Long Tons, Dry Weight)

	Production	Imports	Consumption	Month-End Stocks
Natural latices				
July	0	5,236	4,298	10,171
August	0	—	5,620	12,175
GR-S latices				
July	2,589	0	2,587	5,363
August	1,850	145	2,706	4,355
Neoprene latices				
July	448	0	482	1,004
August	756	0	503	1,010
Nitrile latices				
July	643	0	296	831
August	682	0	324	1,014

SCRAP RUBBER

Slow trading conditions prevailed on the scrap rubber market during the period from September 16 to October 15. Some activity was noted in synthetic Butyl tubes. In general, the trade marked time in anticipation of Naugatuck's placement of mixed auto tire orders.

Prices on all items remained static, except for red passenger tubes, which declined ¼¢ and synthetic Butyl tubes which increased ¼¢, both at Akron.

Current dealers' buying prices for scrap rubber grades, in carload lots delivered to mills at the points indicated, are as follows:

	Eastern Points	Akron, O.
	(Per Net Ton)	
Mixed auto tires	$9.00	$11.50
S. A. G. auto tires	Nom.	13.00
Truck tires	Nom.	14.00
Peelings, No. 1	40.00/41.00	40.00/42.00
2	Nom.	Nom.
3	15.50	Nom.
Tire buffing	18.00/20.00	15.00/16.00
	(¢ per Lb.)	
Auto tubes, mixed	2.75	3.00
Black	4.75	5.00
Red	7.00	7.00
Butyl	2.25	2.50

RECLAIMED RUBBER

Light trading continued on the reclaimed rubber market during the period from September 16 to October 15, but with the new auto models now going into full production, considerable activity is expected before long.

Final July and preliminary August statistics on the domestic industry have been released by the United States Department of Commerce. July figures, in long tons, were: production, 17,907; imports, 134; consumption, 16,301; exports, 586; and month-end stocks, 31,304. Preliminary data for August, in long tons, were: production, 15,452; imports, 135; consumption, 17,432; exports, 827; and month-end stocks, 27,961.

No changes were reported in reclaimed rubber prices during the period, and current prices are as follows:

Reclaimed Rubber Prices

	Lb.
Whole tire: first line	$0.10
Fourth line	.0875
Inner tube: black	.15
Red	.21
Butyl	.125
Pure gum, light colored	.23
Mechanical, light colored	.135

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

COTTON FABRICS

The industrial fabric and cotton duck markets were fairly sluggish during the early part of the period from September 16 to October 15, but trading picked up rapidly toward the end of September and continued moderately active into October.

Trading, especially in heavier wide goods for October delivery, was stimulated by the automotive industry going into full production on 1955-model cars. Drills, drapery fabrics, sateens, and some pocketing twills all displayed firmer tones. The demand for heavy broken twill fabrics continued on to October 15, with coaters purchasing this cloth for deliveries ranging from spot through November. At the same period-end, trading in wide drills and wide sateens, however, slowed, and only limited lots were sold for the most part for quick and nearby shipment.

Trading in hose and belting ducks and chafer fabrics slowed by October 15, since most rubber manufacturers apparently had covered their needs for the next 30 to 45 days.

Among price changes recorded this month was an increase of 5¢ a pound in 10.80 chafer fabric. Other fluctuations were in evidence, but were inconsiderable. Selling prices, f.o.b. shipping point, were as follows on October 15:

Cotton Fabrics

Drills		
59-inch 1.85-yd. *yd.*	$0.345 /	$0.35
2.25-yd.	.295 /	.30
Osnaburgs		
40-inch 2.11-yd. *yd.*	.235 /	.2375
3.65-yd.	.1525 /	.155
Ducks		
38-inch 1.78-yd. S.F. *yd.*	nom.	
2.00-yd. D.F.	nom.	
51.5-inch, 1.35-yd. S.F.	nom.	
Hose and belting	.67	
Raincoat Fabrics		
Printcloth, 38½-inch, 64x60, 5.35-yd. *yd.*	.14	
6.25-yd.	.1188 /	.12
Sheeting, 48-inch, 4.17-yd.	.20	
52-inch, 3.85-yd.	.21	
Chafer Fabrics		
14.30-oz./sq. yd. Pl. *lb.*	.73	
11.65-oz./sq. yd. S.	.65	
10.80-oz./sq. yd. S.	.6875	
8.9-oz./sq. yd. S.	.70	
Other Fabrics		
Headlining, 59-inch, 1.65-yd., 2-ply *yd.*	.4625 /	.465
64-inch, 1.25-yd., 2-ply	.595	
Sateens, 53-inch, 1.32-yd.	.535	
58-inch, 1.21-yd.	.585	

(*Rayon Market report appears on page 304*)

COMPOUNDING INGREDIENTS*

Abrasives

Pumicestone, powdered	lb.	$0.025 /	$0.045
Rottenstone, domestic	lb.	.03 /	.04
Shelblast	ton	80.00 /	165.00

Accelerators

A-1 (Thiocarbanilide)	lb.	.50 /	.57
A-32	lb.	.66 /	.80
A-100	lb.	.52 /	.66
Accelerator 49	lb.	.53 /	.54
108	lb.	.89	
552	lb.	2.25	
808	lb.	.66 /	.68
833	lb.	1.17 /	1.19
Altax	lb.	.48 /	.50
Arazate	lb.	2.25	
Beutene	lb.	.66 /	.71
Bismate	lb.	3.00	
B-J-F	lb.	.27 /	.32
Butasan	lb.	1.04	
Butazate	lb.	1.04	
Butyl Accelerator 21	lb.	.89	
Eight	lb.	1.10 /	1.35
Zimate	lb.	1.04	
Captax	lb.	.38 /	.40
C-P-B	lb.	1.95	
Cumate	lb.	1.45	
Diesterex N	lb.	.50 /	.57
DOTG (diorthotolylguanidine)			
Cyanamid	lb.	.57 /	.58
Du Pont	lb.	.57 /	.58
DPG (diphenylguanidine)			
Cyanamid	lb.	.48 /	.49
Monsanto	lb.	.48 /	.55
El-Sixty	lb.	.50 /	.57
Ethasan	lb.	1.04	
Ethazate	lb.	1.04	
50-D	lb.	.85	
Ethyl Thiurad	lb.	1.04	
Tuads	lb.	1.04	
Tuex	lb.	1.04	
Zimate	lb.	1.04	
Ethylac	lb.	.93 /	.95
Hepteen	lb.	.44 /	.50
Base	lb.	1.85	
Ledate	lb.	1.04	
MBT (2-mercaptobenzo-thiazole)			
Du Pont	lb.	.38 /	.40
Naugatuck	lb.	.38 /	.43
-XXX, Cyanamid	lb.	.49 /	.51
MBTS (mercaptobenzothiazyl disulfide)			
Cyanamid	lb.	.48 /	.50
Du Pont	lb.	.48 /	.50
Naugatuck	lb.	.48 /	.53
-W			
Cyanamid	lb.	.53 /	.55
Mertax	lt.	.49 /	.56
Methasan	lb.	1.04	
Methazate	lb.	1.04	
Methyl Tuads	lb.	1.14	
Zimate	lb.	1.04	
Monex	lb.	1.14	
Mono-Thiurad	lb.	1.14	
Morfex	lb.	.65 /	.70
NOBS No. 1	lb.	.69 /	.71
Special	lb.	.79 /	.81
O-X-A-F	lb.	.49 /	.54
Pentex	lb.	1.04	
Flour	lb.	.21	
Permalux	lb.	2.17	
Phenex	lb.	.52 /	.59
Pip-Pip	lb.	2.07	
R-2 Crystals	lb.	4.35	
Rotax	lb.	.49 /	.51
RZ-50, -50B	lb.	1.00	
S. A. 52	lb.	1.14	
57, 62, 67, 77	lb.	1.04	
66	lb.	2.50	
Santocure	lb.	.69 /	.76
Selenacs	lb.	2.60	
SPDX-GH	lb.	.64 /	.69
GL	lb.	.95	
Tellurac	lb.	1.21	
Tepidone	lb.	.45	
Tetrone A	lb.	1.91	
Thiofide	lb.	.48 /	.55
S	lb.	.50 /	.57
Thionex	lb.	1.14	
Thiotax	lb.	.38 /	.45
Thiurad	lb.	1.14	
Thiuram E	lb.	1.04	
M	lb.	1.14	
Trimene	lb.	.56 /	.62
Base	lb.	1.03 /	1.10
Tuex	lb.	1.14	
Ultex	lb.	1.00 /	1.10
Unads	lb.	1.14	
Ureka Base	lb.	.66 /	.73
Vulcacure NB	lb.	.45	
ZB, ZE, ZM	lb.	.85	
Z-B-X	lb.	2.45 /	
Zenite	lb.	.48 /	.50
A	lb.	.49 /	.51
Special	lb.	.49 /	.51
Zetax	lb.	.49 /	.51
Zimate	lb.	1.04	

* Prices, in general, are f.o.b. works. Range indicates grade or quantity variations. No guarantee of these prices is made. Spot prices should be obtained from individual suppliers.

† For trade names, see Color—White, Zinc Oxides.

THIS listing of "Compounding Ingredients" has been largely expanded from previous listings in RUBBER WORLD and closely follows the classification of chemicals as found in our book, "Compounding Ingredients for Rubber." Readers are referred to this source for identification of brand names.

Government synthetic rubbers are now included in this list as well as privately produced synthetic rubbers. Suppliers using an abbreviated chemical name for their product are grouped under the abbreviated designation; while product names not using the abbreviation are listed alphabetically; for example, du Pont's MBT is under the MBT group of accelerators; whereas Vanderbilt's Captax (another 2-mercaptobenzothiazole) can be found under the C's. All latex compounding ingredients are grouped under that classification, with some sub-classification according to the physical state of the products, that is, dispersions and emulsions.

Suppliers are requested to submit product additions and price changes promptly as they occur in order that we may make the listing of maximum service to our readers. Comments on the present listing and classifications are invited with a view toward facilitating location of specific items. EDITOR

Accelerator-Activators, Inorganic

Lime, hydrated	ton	$10.00 /	$17.50
Litharge, comml	lb.	.1625 /	.1675
Eagle, sublimed	lb.	.171	
National Lead, sublimed	lb.	.17 /	.18
Red lead, comml	lb.	.165 /	.175
Eagle	lb.	.18	
National Lead	lb.	.18 /	.1925
White lead, carbonate	lb.	.165 /	.175
Eagle	lb.	.165 /	.175
National Lead	lb.	.175 /	.185
White lead, silicate	lb.	.155 /	.1875
Eagle	lb.	.175 /	.1925
National Lead	lb.	.16 /	.18
Zinc oxide, comml.†	lb.	.135 /	.1775

Accelerator-Activators, Organic

Aktone	lb.	.22 /	.23
Barak	lb.	.62	
Capital 170	lb.	.22 /	.255
171	lt.	.1125 /	.1475
700, 701	lb.	.135 /	.17
705, 710	lb.	.14 /	.175
800	lb.	.1025 /	.12
801	lb.	.1225 /	.14
802	lb.	.1275 /	.145
803	lb.	.15 /	.1675
Curade	lb.	.57 /	.59
D-B-A	lb.	1.95	
Emery 600	lb.	.1125 /	.1475
Groco 30	lb.	.1125 /	.1475
35	lb.	.1175 /	.1525
Guantal	lb.	.57 /	.64
Hyfac 400	lb.	.095 /	.12
430	lb.	.135 /	.16
431	lb.	.1575 /	.1825
Hystrene S-97	lb.	.18 /	.2025
T-45	lb.	.145 /	.1675
T-70	lb.	.155 /	.1775
Industrene	lb.	.1125 /	.135
B	lb.	.1125 /	.135
R	lb.	.0975 /	.12
Laurex	lb.	.33 /	.37
MODX	lb.	.295 /	.345
NA-22	lt.	1.50	
Oleic acid, comml	lb.	.13 /	.19
Emersol 210 Elaine	lb.	.13 /	.165
Groco 2, 4, 8, 18	lb.	.14 /	.175
Wilmar 110	lb.	.14 /	.175

Plastone	lb.	$0.27 /	$0.30
Polyac	lb.	1.65	
Ridacto	lb.	.25 /	.26
Seedine	lb.	.1485 /	.1705
Stearex Beads	lb.	.1488 /	.1588
Stearic acid			
Emersol 111	lb.	.11 /	.13
120	lb.	.12 /	.145
130	lb.	.1425 /	.1675
Groco 52	lb.	.1075 /	.125
Hydrofol 51	lb.	.09	
Hydrogenated, rubber grade			
Groco	lb.	.1025 /	.12
Rufat 75	lb.	.095 /	.12
Single pressed, comml	lb.	.1225 /	.14
Emersol 110	lb.	.115 /	.14
Groco 53	lb.	.1225 /	.14
Wilmar 253	lb.	.115 /	.14
Double pressed, comml	lb.	.1275 /	.145
Groco 54	lb.	.1275 /	.145
Wilmar 254	lb.	.12 /	.145
Triple pressed, comml	lb.	.15 /	.1675
Groco 55	lb.	.15 /	.1675
Wilmar 255	lb.	.1425 /	.1675
Sterene 60-R	lb.	.09 /	.1075
Tonox	lb.	.515 /	.605
Vulklor	lt.	.75 /	.95
Wilmar 434	lb.	.1125 /	.1434
Zinc stearate, comml	lb.	.37 /	.42

Antioxidants

AgeBest A26	lb.	.18 /	.24
620-32B	lb.	.20 /	.26
716-30	lb.	.18 /	.24
1041-21	lb.	.165 /	.225
1293-22A	lb.	1.90 /	2.00
AgeRite Alba	lb.	2.35 /	2.45
Gel	lb.	.64 /	.66
H. P.	lb.	.72 /	.74
Hipar	lb.	.98 /	1.00
Powder	lb.	.52 /	.54
Resin	lb.	.75 /	.77
D	lb.	.52 /	.54
Spar	lb.	.52 /	.54
Stalite	lb.	.52 /	.54
S	lb.	.52 /	.54
White	lb.	1.45 /	1.55
Akroflex C	lb.	.72 /	.79
CD	lb.	.72 /	.74
Albasan	lb.	.69 /	.73
Allied AA-1144	lb.	.23 /	.24
AA-1177	lb.	.155 /	.165
Aminox	lb.	.52 /	.57
Antioxidant 2246	lb.	1.65 /	1.68
Antisol	lb.	.23 /	.24
Antisun	lb.	.15 /	.175
Antox	lb.	.52 /	.54
Aranox	lb.	3.25	
Betanox Special	lb.	.80 /	.85
B-L-E, -25	lb.	.52 /	.57
Burgess Antisun Wax	lb.	.185	
B-X-A	lb.	.52	.57
Copper Inhibiter X-872-L	lb.	2.01	
D-B-P-C	lb.	.91 /	1.16
Flectol H	lb.	.52 /	.59
Flexamine	lb.	.72 /	.77
Heliozone	lb.	.26 /	.27
Ionol	lb.	.91 /	1.40
NBC	lb.	1.55	
Neozone A	lb.	.56 /	.58
D	lb.	.52 /	.54
Octamine	lb.	.52 /	.57
Perflectol	lb.	.61 /	.68
Polygard	lb.	.52 /	.57
Protector	lb.	.26 /	.31
Rio Resin	lb.	.60 /	.62
Santoflex 35	lb.	.72 /	.79
AW	lb.	.78 /	.85
B	lb.	.52 /	.59
BX	lb.	.63 /	.70
Santovar A	lb.	1.50 /	1.57
SantowhiteCrystals, Powder	lb.	1.60 /	1.67
L	lb.	.52 /	.59
MK	lb.	1.29 /	1.36
Sharples Wax	lb.	.23 /	.28
Stabilite	lb.	.55 /	.59
Alba	lb.	.72 /	.79
L	lt.	.60 /	.64
White	lb.	.53 /	.62
Powder	lb.	.41 /	.47
Styphen I	lb.	.51 /	.55
Sunolite #100	lb.	.21 /	.23
#127	lb.	.17 /	.19
Sunproof -713	lb.	.25 /	.30
Improved	lb.	.25 /	.30
Jr.	lb.	.20 /	.25
Thermoflex A	lb.	.98 /	1.00
Tonox	lb.	.52 /	.57
Tysonite	lb.	.24 /	.2475
Velvapex 51-250	lb.	.40	
V-G-B	lb.	.70 /	.75
Wing-Stay S	lb.	.52 /	.61
Zenite	lb.	.33 /	.35

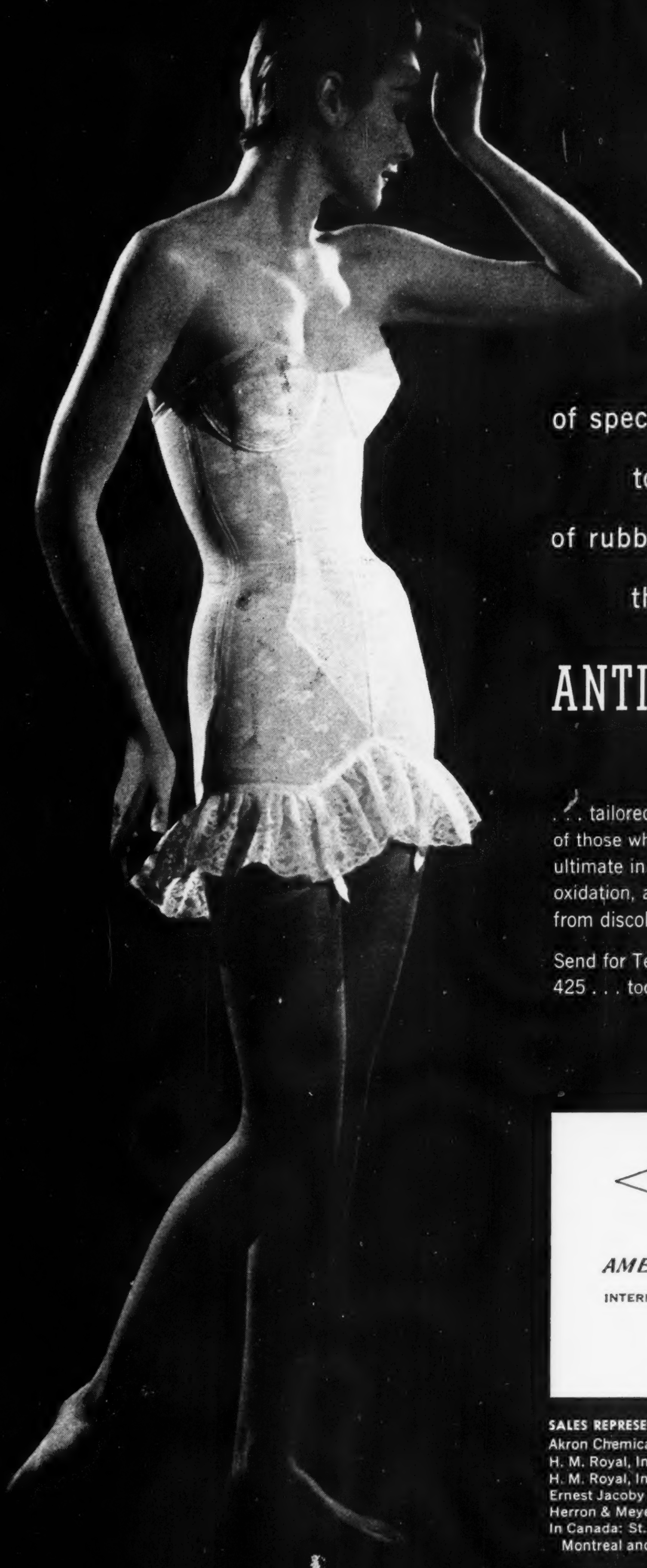
Antiseptics

Copper naphthenate, 6-8%	lb.	.235	
Pentachlorophenol	lb.	.21 /	.29
Resorcinol, technical	lb.	.775 /	.785
Zinc naphthenate, 8-10%	lb.	.245 /	.30

Blowing Agents

Ammonium bicarbonate	lb.	.065 /	.075
Carbonate	lb.	.23 /	.24
Blowing Agent CP-975	lb.	.35	

/	$0.30
/	.26
5/	.1705
8/	.1588
/	.13
/	.145
5/	.1675
5/	125
5/	.12
/	.12
5/	.14
/	.14
5/	.14
/	.14
5/	.145
5/	.145
/	.145
/	.1675
/	.1675
5/	.1675
/	.1075
/	.605
/	.95
5/	.1434
/	.42
/	.24
/	.26
/	.24
/	.225
/	2.00
/	2.45
/	.66
/	.74
/	1.00
/	.54
/	.77
/	.54
/	.54
/	.54
/	.54
/	1.55
/	.79
/	.74
/	.73
/	.24
/	.165
/	.57
/	1.68
/	.24
/	.175
/	.54
/	.85
/	.57
/	.57
/	1.16
/	.59
/	.77
/	.27
/	1.40
/	.58
/	.54
/	.57
/	.68
/	.57
/	.31
/	.62
/	.79
/	.85
/	.59
/	.70
/	1.57
/	1.67
/	.59
/	1.36
/	.28
/	.59
/	.79
/	.64
/	.62
/	.47
/	.55
/	.23
/	.19
/	.30
/	.30
/	.25
/	1.00
/	.57
/	.2475
/	.75
/	.61
/	.35
/	.29
/	.785
/	.30
/	.075
/	.24



Celogen	lb.	$1.95	
50-C	lb.	1.01 /	$1.07
Sodium bicarbonate	100 lbs.	2.70 /	3.30
Carbonate, tech	100 lbs.	1.35 /	5.52
Sponge Paste	lb.	.20	
Unicel	lb.	.90	
ND	lb.	.79	
S	lb.	.20	

Bonding Agents

Braze	gal.	6.00 /	9.00
Cover cement	gal.	2.50 /	4.00
Flocking Adhesive RFA17, RFA22, RFA25	lb.	.50	
G-E Silicone Paste SS-15	lb.	4.52 /	5.10
SS-64	lb.	3.65 /	6.75
-67 Primer	lb.	7.50 /	12.50
Gen-Tac Latex	lb.	.75 /	.855
Kalabond Adhesive	gal.	6.50 /	16.00
Tie Cement	gal.	2.00 /	5.60
MDI	lb.	4.00 /	6.00
-50	lb.	2.00 /	3.00
Thixons	gal.	1.48 /	12.00
Ty Ply BN, Q, S, UP, 3640	gal.	6.75 /	8.00
RC	gal.	3.75 /	5.00

Brake Lining Saturants

BRT 3	lb.	.018 /	.0265
Resinex L-S	lb.	.0225/	.03

Carbon Blacks‡

Conductive Channel—CC

Continental R-40	lb.	.23 /	.30
Kosmos/Dixie BB	lb.	.23 /	.30
Spheron C	lb.	.14 /	.185
Voltex	lb.	.18 /	.315

Easy Processing Channel—EPC

Continental AA	lb.	.074 /	.1225
Kosmobile 77/Dixiedensed 77	lb.	.074 /	.1225
Micronex W-6	lb.	.074 /	.1225
Spheron #9	lb.	.074 /	.1225
Texas E	lb.	.07 /	.1225
Witco #12	lb.	.074 /	.1225
Wyex	lb.	.074 /	.12

Hard Processing Channel—HPC

Continental F	lb.	.074 /	.1225
HX	lb.	.074 /	.12
Kosmobile S/Dixiedensed S	lb.	.074 /	.1225
Micronex Mk. II	lb.	.074 /	.1225
Spheron #4	lb.	.074 /	.1225
Witco #6	lb.	.074 /	.1225

Medium Processing Channel—MPC

Arrow TX	lb.	.074 /	.12
Continental A	lb.	.074 /	.1225
Kosmobile S-66/Dixiedensed S-66	lb.	.074 /	.1225
Micronex Standard	lb.	.074 /	.1225
Spheron #6	lb.	.074 /	.1225
Texas 109	lb.	.079	
Texas M	lb.	.07 /	.1225
Witco #1	lb.	.074 /	.1225

Conductive Furnace—CF

Aromex 115	lb.	.089 /	.129
Vulcan C	lb.	.105 /	.15
SC	lb.	.18 /	.223

Fast Extruding Furnace—FEF

Arovel	lb.	.06 /	.10
Continex FEF	lb.	.06 /	.10
Kosmos 50/Dixie 50	lb.	.06 /	.10
Statex M	lb.	.06 /	.10
Sterling SO	lb.	.06 /	.10

Fine Furnace—FF

Statex B	lb.	.065 /	.105
Sterling 99	lb.	.065 /	.105

High Abrasion Furnace—HAF

Aromex	lb.	.079 /	.125
Continex HAF	lb.	.079 /	.125
Kosmos 60/Dixie 60	lb.	.079 /	.1175
Philblack O	lb.	.079 /	.119
Statex R	lb.	.079 /	.125
Vulcan #3	lb.	.079 /	.125

Medium Abrasion Furnace—MAF

Philblack A	lb.	.06 /	.10

Super Abrasion Furnace—SAF

Aromex 125	lb.	.105 /	.145
Kosmos 70/Dixie 70	lb.	.11 /	.155
Philblack E	lb.	.135 /	.175
I	lb.	.101 /	.145
Statex 125	lb.	.105 /	.15
Vulcan 6	lb.	.105 /	.15
9	lb.	.135 /	.178

General-Purpose Furnace—GPF

Sterling V	lb.	.05 /	.09
V Non-staining	lb.	.05 /	.09

‡ At the request of the suppliers, the lowest prices shown for carbon blacks are for carloads in bags. Prices for hopper carloads are lower.

High Modulus Furnace—HMF

Continex HMF	lb.	$0.055 /	$0.095
Kosmos 40/Dixie 40	lb.	.055 /	.095
Modulex	lb.	.055 /	.095
Statex 93	lb.	.055 /	.095
930	lb.	.047 /	.087
Sterling L, LL	lb.	.055 /	.095

Semi-Reinforcing Furnace—SRF

Continex SRF	lb.	.045 /	.085
Essex	lb.	.045 /	.085
Furnex	lb.	.045 /	.085
Gastex	lb.	.05 /	.09
Kosmos 20/Dixie 20	lb.	.045 /	.085
Pelletex, NS	lb.	.045 /	.085
Sterling NS, S	lb.	.045 /	.085
R	lb.	.05 /	.09

Fine Thermal—FT

P-33	lb.	.055	
Sterling FT	lb.	.055	

Medium Thermal—MT

Sterling MT	lb.	.035	
Non-staining	lb.	.045	
Thermax	lb.	.035	
Stainless	lb.	.045	

Chemical Stabilizers

Argus stabilizers	lb.	.60 /	1.38
Dutch Boy DS-207	lb.	.54	
Dyphos	lb.	.57	
Dythal	lb.	.395	
Normasal	lb.	.46	
Plumb-O-Sil A	lb.	.2975	
B	lb.	.3125	
C	lb.	.3425	
Tribase	lb.	.265	
E	lb.	.215	
Lead Stearate			
Mathe #30 fused	lb.	.32 /	.37
Oiled	lb.	.40 /	.45
#50	lb.	.53 /	.57
P-30	lb.	.39 /	.44
Witco #30	lb.	.32 /	.37
P-30	lb.	.29 /	.44
Mark M	lb.	.77 /	.91
XI	lb.	.87 /	1.01
XV	lb.	.92 /	1.01
XX	lb.	.63 /	.74
Stabelan HR-50	lb.	.75 /	.90
Stabelans	lb.	.60 /	1.70
Staycin 1	lb.	.65	
Stayrite #10	lb.	.32 /	.37
#15	lb.	.53 /	.57
#20	lb.	.37 /	.42
#22	lb.	1.40 /	1.44
#25	lb.	.35 /	.40
#70, 80, 90	lb.	.70	
P-10	lb.	.39 /	.44
Trenamine T-2039-B-1	lb.	.12	
Vanstay HT	lb.	.90 /	.92
L	lb.	.33 /	.35
S	lb.	.65 /	.70
White lead silicates, basic	lb.	.155 /	.1875
Eagle #201	lb.	.1825/	.1925
#202	lb.	.175 /	.185
National Lead	lb.	.16 /	.17

Colors

Black

Black Paste #25	lb.	.22 /	.40
Claremont vinyl paste	gal.	.45 /	.58
Covinylblaks	lb.	.68 /	.145
Iron oxides, comml	lb.	.1275	
BK—Lansco	lb.	.1275/	.13
Williams	lb.	.1275/	.13
Lansco synthetic	lb.	.10	
Mapico	lb.	.1275/	.13
Lampblack, comml	lb.	.16 /	.45
Superjet	lb.	.0825/	.1175
MB Mineral Blacks	lb.	.0315/	.0675
Stan-Tone	lb.	.45 /	1.20
Vansul masterbatch	lb.	.60 /	.65
Paste	lb.	.14 /	.15

Blue

Claremont vinyl pastes	gal.	.62 /	1.51
Du Pont	lb.	1.77 /	4.55
Filo	lb.	.28	
Heveatex pastes	lb.	.80 /	1.45
Lansco ultramarines	lb.	.25 /	.28
Monsanto Blue 7	lb.	1.55	
11	lb.	3.45	
DPB-283	lb.	1.93	
S-11	lb.	2.05	
Stan-Tone	lb.	1.55 /	1.60
Toners	lb.	.30 /	3.50
Vansul masterbatch	lb.	.90 /	2.70

Brown

Brown Paste #5, #10	lb.	.35 /	.45
Filo	lb.	.13	
Iron oxides, comml	lb.	.1375/	.14
Claremont vinyl paste	gal.	.475 /	.495
Lansco synthetic	lb.	.125	
Mapico Brown	lb.	.1375/	.14
Brown 422	lb.	.14	
Sienna, burnt, comml	lb.	.0425/	.155
Williams	lb.	.11 /	.1725
Raw, comml	lb.	.045 /	.1325
Williams	lb.	.08 /	.1725
Umber, burnt, comml	lb.	.06 /	.07
Williams	lb.	.0675/	.08
Raw, comml	lb.	.0625/	.07
Williams	lb.	.07 /	.0825
Williams			
Pure brown	lb.	.1375/	.14
Vandyke	lb.	.12	
Mapico Tan 20	lb.	$0.2025/	$0.205
Tan 15	lb.	.205	
Metallic brown	lb.	.04 /	.05
Plastics brown	lb.	.0625/	.07
Vansul masterbatch	lb.	2.10 /	2.20

Green

Chrome	lb.	.19 /	.50
Chrome oxide	lb.	.3925/	1.10
G-4099, -6099	lb.	.3925/	.3975
GH-9869	lb.	1.00 /	1.15
9976	lb.	1.10 /	1.25
Claremont vinyl pastes	gal.	1.86 /	1.88
Du Pont	lb.	1.97 /	3.20
Filo	lb.	.40	
Heveatex pastes	lb.	.95 /	1.85
Lansco Toner	lb.	1.35	
Monsanto Green 3	lb.	2.75	
14	lb.	1.45	
17	lb.	3.95	
71205	lb.	1.35	
DGP	lb.	2.03	
S-17	lb.	2.25	
Stan-Tone	lb.	1.75 /	4.60
Toners	lb.	.35 /	4.00
Vansul masterbatch	lb.	2.00 /	2.60

Orange

Claremont vinyl pastes	gal.	.70 /	.72
Du Pont	lb.	2.75	
Monsanto Orange 68187	lb.	2.90	
Orange Paste #13	lb.	1.35 /	1.50
Stan-Tone	lb.	.70 /	3.35
Toners	lb.	.30 /	1.50
Vansul masterbatch	lb.	2.00 /	2.60

Red

Antimony trisulfide	lb.	.27 /	.30
R. M. P. No. 3	lb.	.72	
Sulfur Free	lb.	.78	
Cadmium red lithopone	lb.	1.64 /	2.05
Cadmolith	lb.	1.72 /	2.20
Claremont vinyl pastes	gal.	1.10 /	2.22
Du Pont	lb.	1.47 /	1.80
Filo	lb.	.11	
Indian Red	lb.	.1275	
Iron oxide, comml	lb.	.06 /	.13
Claremont vinyl pastes	gal.	.44 /	.515
Lansco synthetic	lb.	.1175	
Mapico	lb.	.1275/	.13
Recco	lb.	.12	
Williams Red	lb.	.1275/	.15
Monsanto Red 7	lb.	1.55	
41	lb.	4.40	
3501	lb.	1.15	
4004	lb.	1.50	
69191	lb.	3.38	
Autumn	lb.	1.10	
PRP-285	lb.	1.27	
S-44	lb.	1.28	
Maroon 113	lb.	1.50	
61148	lb.	1.75	
Red Paste #17, I-2	lb.	.95 /	1.10
Rub-Er-Red	lb.	.0975	
Stan-Tone	lb.	1.05 /	4.05
Toners	lb.	.25 /	4.15
Tuscan	lb.	.15 /	.46
Vansul masterbatch	lb.	.95 /	3.30
Venetian	lb.	.035 /	.0625

White

Antimony oxide	lb.	.29 /	.305
Burgess Iceberg	ton	50.00 /	80.00
Claremont vinyl pastes	gal.	.45 /	.58
Lithopone, titanated	lb.	.10 /	.11
Cryptone BT	lb.	.10 /	.11
Permolith	lb.	.075 /	.085
Titanium pigments			
Rayox LW	lb.	.195 /	.205
R-110	lb.	.215 /	.225
Ti-Cal	lb.	.075 /	.0825
Ti-Pure	lb.	.195 /	.225
Titanox A, AA, A-168	lb.	.21 /	.22
C-50	lb.	.1225/	.1275
RA, -10, -50	lb.	.23 /	.24
RC	lb.	.0825/	.0875
-HT, -HTX	lb.	.08 /	.085
Zopaque Anatase	lb.	.225 /	.235
Rutile	lb.	.245 /	.255
Zinc oxide, comml	lb.	.135 /	.1775
Azo ZZZ-11, -44, -55	lb.	.135 /	.155
20% leaded	lb.	.1395/	.1595
35% leaded	lb.	.1425/	.1625
50% leaded	lb.	.14625/	.16625
Eagle AAA, lead free	lb.	.135 /	.145
5% leaded	lb.	.135 /	.145
35% leaded	lb.	.1425/	.1525
50% leaded	lb.	.14625/	.15625
Florence Green Seal	lb.	.1525/	.1625
Red Seal	lb.	.1475/	.1575
White Seal	lb.	.1575/	.1675
Horsehead XX-4, -78	lb.	.135 /	.145
Kadox -15, -17, -22	lb.	.135 /	.145
-25	lb.	.1575/	.1675
Lehigh, 35% leaded	lb.	.14 /	.15
50% leaded	lb.	.14⅛/	.15⅛
Protox-166, -167	lb.	.135 /	.145
St. Joe, lead free	lb.	.135 /	.145
Zinc sulfide, comml	lb.	.253 /	.263
Cryptone ZS	lb.	.253 /	.263

Yellow

Cadmium yellow lithopone	lb.	1.15	
Cadmolith	lb.	1.12 /	1.20

Claremont vinyl pastes	gal.	$0.55	/ $1.68
Chrome	lb.	.31	
Du Pont	lb.	1.80	/ 2.15
Filo	lb.	.10	
Iron oxide, comml	lb.	.0525	/ .1075
Claremont vinyl paste	gal.	.44	/ .46
Lansco synthetic	lb.	.1075	
Mapico	lb.	.105	/ .1075
Williams	lb.	.105	/ .1075
Monsanto Yellow 14	lb.	1.91	
10010	lb.	1.91	
BYP-282	lb.	1.21	
GA	lb.	2.45	
S-10010	lb.	1.17	
Stan-Tone	lb.	1.00	/ 1.55
Toners	lb.	.50	/ 1.37
Vansul masterbatch	lb.	.95	/ 1.95
Williams Ocher	lb.	.0525	/ .055
Yellow D	lb.	1.25	/ 1.35

Dusting Agents

Diatomaceous silica	ton	32.00	/ 48.00
Extrud-o-Lube, conc	gal.	1.54	/ 1.69
Glycerized Liquid Lubricant, concentrated	gal.	1.48	/ 1.63
Latex-Lube GR	lb.	.20	
Pigmented	lb.	.1825	
R-66	lb.	.165	
Liqui-Lube	lb.	.1625	
N. T.	lb.	.1675	
Liquizinc No. 305	lb.	.30	/ .35
Lubrex	lb.	.25	/ .30
Mica Concord	lb.	.075	/ .0825
Mineralite	ton	45.00	
Pyrax A	ton	13.50	
W. A.	ton	16.00	
Snow Crest Talc	ton	33.00	/ 35.00
Talc, comml	ton	14.00	/ 38.50
EM	ton	11.00	/ 63.00
LS Silver	ton	29.25	
Nytals	ton	25.00	/ 36.00
Sierra Sagger 7	ton	34.00	
Sierra white IR	ton	19.75	
III	ton	20.75	
Vanfre	gal.	2.00	/ 2.50

Extenders

BRS 700	lb.	.02	/ .0285
BRT 7	lb.	.03	/ .031
Cumar Resins	lb.	.065	/ .17
Dielex B	lb.	.06	
Factice, Amberex	lb.	.29	/ .36
Brown	lb.	.1425	/ .268
Neophax	lb.	.157	/ .268
White	lb.	.144	/ .285
G.B. Asphaltenes	lb.	.06	/ .065
Millex, W	lb.	.07	
Mineral Rubbers			
Black Diamond	ton	38.00	/ 40.00
Hard Hydrocarbon	ton	46.50	/ 48.50
Hydrocarbon MR	ton	45.00	/ 55.00
Parmr	ton	21.00	/ 29.00
T-MR Granulated	ton	47.50	/ 50.00
Nuba No. 1, 2	lb.	.0575	/ .0625
3X	lb.	.0775	/ .0825
OPD-101	lb.	.26	
Rubber substitute, brown	lb.	.122	/ .22
Car-Bel-Ex A	lb.	.14	
Car-Bel-Lite	lb.	.35	
Extender 600	lb.	.1765	
White	lb.	.148	/ .256
Stan-Shells	ton	35.00	/ 73.00
Synthetic 100	lb.	.41	

Fillers, Inert

Agrashell flour	ton	50.00	/ 74.00
Barytes, floated, white	ton	41.60	/ 60.10
Off-color, domestic	ton	25.00	
No. 1	ton	41.35	/ 60.10
2	ton	39.35	/ 58.00
Sparmite	ton	75.00	/ 80.00
Blanc fixe	ton	100.00	/ 165.00
Burgess Iceberg	ton	50.00	/ 80.00
Pigment #20	ton	35.00	/ 60.00
#30	ton	37.00	/ 60.00
HC-75	ton	12.00	/ 30.00
HC-80	ton	14.00	/ 32.00
WP #1	ton	11.00	/ 16.00
Cary #200	ton	30.00	/ 55.00
Citrus seed meal	lb.	.04	
Oil	lb.	.15	
Clays			
Aiken	ton	14.00	
Albacar	ton	50.00	/ 55.00
Aluminum Flake	ton	20.00	/ 60.00
#5	ton	23.50	/ 30.00
Champion	ton	14.00	
Crown	ton	14.00	/ 33.00
Dixie	ton	14.00	
Franklin	ton	13.50	/ 35.25
Gepico 10	ton	14.00	
20	ton	12.00	
30	ton	14.50	
40	ton	13.50	
GK Soft Clay	ton	11.00	
Hi-White R	ton	13.50	
Hydratex R	ton	28.00	
Kaolloid	ton	10.50	
Laminar	ton	30.00	
Paragon	ton	13.50	/ 31.50
McNamee	ton	13.50	
RX-43	ton	33.00	
Recco	ton	14.00	
Sno-Brite	ton	12.50	
Stan-Clay	ton	28.00	
Stellar-R	ton	$50.00	
Suprex	ton	14.00	/ $32.00
Swanee	ton	12.50	
W-1291 English	ton	53.00	/ 55.00
Windsor	ton	14.00	/ 30.00
Cryptone BA, CB, MS	lb.	.08	/ .0825
Diatomaceous silica	ton	32.00	/ 48.00
Flocks			
Cotton, dark	lb.	.095	/ .135
Dyed	lb.	.55	/ .60
White	lb.	.13	/ .33
Fabrifil X-24-G	lb.	.135	
X-24-W	lb.	.235	
Filfloc 6000	lb.	.33	
F-40-900	lb.	.135	
Kalite	ton	50.00	/ 65.00
Lithopone, comml	lb.	.075	/ .085
Albalith	lb.	.075	/ .085
Astrolith	lb.	.06¾	/ .0675
Eagle	lb.	.0725	/ .075
Sunolith	lb.	.075	/ .0825
Mica Concord	lb.	.075	/ .0825
Millical	ton	35.00	/ 50.00
Mineralite	ton	40.00	/ 60.00
No. 1 Silica	ton	22.00	/ 40.00
Non-Fer-Al	ton	30.00	/ 45.00
Purecal	ton	56.75	/ 71.75
Pyrax A	ton	13.50	
W. A.	ton	16.00	
Sawdust	ton	14.00	/ 33.00
SL Slate Flour	ton	17.00	/ 25.00
Stan-White	ton	8.50	/ 9.45
Super-White Silica	ton	23.00	/ 43.00
Suspenso	ton	33.00	/ 48.00
Terra Alba 1319	ton	27.00	
Ti-Cal	lb.	.0675	
Whiting, limestone	ton	32.00	/ 34.00
Atomite	ton	30.00	
Calcite	ton	21.50	
Keystone	ton	16.00	
Omya	ton	30.00	
Paxinosa	ton	10.00	/ 18.00
Snowflake	ton	17.00	/ 18.00
Stonelite	ton	9.00	
Witco	ton	8.50	
York	ton	9.50	

Finishes

Apex Bright Finish #5200-E	lb.	.25	
Rubber Finish	gal.	2.50	
Black-out	gal.	4.50	/ 8.00
Flocks			
Rayon, colored	lb.	.90	/ 1.50
White	lb.	.75	/ 1.25
Also see Flocks, under Fillers, Inert			
Rubber lacquer, clear	gal.	1.00	/ 2.00
Colored	gal.	2.00	/ 3.50
Shellacs, Angelo	lb.	.485	/ .7325
Vac Dry	lb.	.485	/ .57
Shoe varnish	gal.	1.45	
Talc *(See Talc under Dusting Agents)*			
Unidip	lb.	.15	/ .20
Wax, Bees	lb.	.55	/ .75
Carnauba	lb.	.79	/ 1.15
Montan	lb.	.135	/ .32
No. 118, colors	gal.	.86	/ 1.41
Neutral	gal.	.76	/ 1.31
Van Wax	gal.	1.45	/ 1.50

Latex Compounding Ingredients

Acintol D, DLR	lb.	.06	/ .075
FA #1	lb.	.065	/ .08
#2	lb.	.075	/ .09
Accelerator 552	lb.	2.25	
J-117, -302	lb.	1.00	/ 1.15
-144	lb.	.15	/ .30
-307	lb.	1.10	/ 1.25
-311	lb.	.60	/ .75
Aerosol, dry types	lb.	.39	/ 1.20
Liquid types	lb.	.40	/ .72
Alcogum AN-6	lb.	.05	
AN-10	lb.	.085	
Alrosol	lb.	.41	
Alrowet D-75	lb.	.63	
Amberex solutions	lb.	.1675	/ .18
Antifoam J-114	lb.	3.25	/ 3.45
P-242	lb.	.24	/ .35
Antioxidant J-137, -140	lb.	.55	/ .70
-139, -293	lb.	1.45	/ 1.60
-182	lb.	2.00	/ 2.15
-186	lb.	1.40	/ 1.55
2246	lb.	1.65	/ 1.68
Anti-Webbing Agent J-183	lb.	.75	/ .90
-297	lb.	.27	/ .40
Aquablak B	lb.	.0925	/ .0975
G	lb.	.105	/ .11
K	lb.	.1075	/ .1125
M	lb.	.085	/ .09
Aquarex D	lb.	.78	
G	lb.	.21	
L, ME	lb.	.94	
MDL	lb.	.33	
NS	lb.	.60	
SMO	lb.	.50	
WAQ	lb.	.25	
Areskap 50	lb.	.30	/ .38
100, dry	lb.	.60	/ .72
Aresket 240	lb.	.30	/ .38
300, dry	lb.	.60	/ .72
Aresklene 375	lb.	.42	/ .57
Ben-A-Gels	lb.	.98	/ 1.40
Bentone 18, 18C	lb.	.45	
34	lb.	.60	
Casein	lb.	.22	
Cellosize WP-09, -3, -300	lb.	1.36	/ 1.60
Coagulant P-379	gal.	1.30	/ 1.90
-392	gal.	1.55	/ 2.15
CW-12	lb.	$0.85	
37	lb.	.70	
Defoama W-1701	lb.	.125	
Defoamer 115a	lb.	.50	
Dispersing Agents			
Blancol	lb.	.1525	/ $0.26
N	lb.	.155	/ .26
Darvan Nos. 1, 2, 3	lb.	.22	/ .30
Daxad 11, 21, 23, 27	lb.	.08	/ .30
Dispersaid H7A	lb.	.58	
1159	lb.	.43	
Emulphor ON-870	lb.	.50	/ .70
Igepal CO-630	lb.	.2875	/ .47
Igepon T-73	lb.	.285	/ .495
T-77	lb.	.45	/ .69
Indulins	lb.	.06	/ .08
Kreelons	lb.	.132	/ .155
Laurelton Oil	lb.	.18	
Leonil SA	lb.	.52	/ .65
Lomar PW	lb.	.18	
Marasperse CB	lb.	.1225	/ .1425
N	lb.	.095	/ .105
Modicols	lb.	.17	/ .58
Nekal BA-75	lb.	.395	/ .54
BX-76	lb.	.63	/ .75
Pluronics	lb.	.335	/ .40
Polyfons	lb.	.08	/ .09
Sorapon SF-78	lb.	.28	/ .40
Tergitol NPX	lb.	.275	/ .3074
TMN	lb.	.2875	/ .32
7	lb.	.4125	/ .44
Trenamine	lb.	.15	
Triton R-100	lb.	.12	/ .25
X-100, -102, -114	lb.	.255	/ .36
Dispersions			
AgeRite Alba	lb.	3.00	
Powder, Resin D	lb.	.80	
White	lb.	1.80	
Altax	lb.	.75	
Black No. 25	lb.	.22	
Black Shield Nos. 2, 6	lb.	.08	
3	lb.	.095	
4-35	lb.	.09	
5	lb.	.093	
7-F, 8	lb.	.165	
55	lb.	.18	
Iron oxide, 60%	lb.	.40	
No. 305 Liquizinc	lb.	.30	/ .35
L.S.W.	lb.	1.50	
P-33	lb.	.35	
Rayox	lb.	.45	
Rotax	lb.	.75	
Sulfur	lb.	.12	/ .30
No. 2	lb.	.14	/ .16
Telloy	lb.	3.00	
Tuads, Methyl	lb.	1.60	
Vulcanizing			
C group	lb.	.40	/ 1.30
G group	lb.	.45	/ .90
N group	lb.	.40	/ 1.00
Zetax	lb.	.75	
Zimates, Butyl	lb.	1.30	
Ethyl, Methyl	lb.	1.35	
Zinc oxide	lb.	.40	
Emulsions			
AgeRite Stalite	lb.	.75	
Habuco Resin Nos. 502, 515, 523	lb.	.195	/ .20
503	lb.	.22	/ .225
504, 526	lb.	.19	/ .195
517	lb.	.175	/ .18
524	lb.	.155	/ .16
Resin A-2	lb.	.16	/ .25
P-370	lb.	.175	/ .25
X-210	lb.	.12	/ .22
Freeze-Stabilizer 322	lb.	.40	
12116C	lb.	.52	
Gelling Agent P-397	lb.	.34	/ .37
Igepon T-43	lb.	.145	/ .35
T-51	lb.	.125	/ .285
-73	lb.	.285	/ .495
Indulins	lb.	.06	/ .08
Laton L	lb.	.075	/ .0775
Ludox	lb.	.1675	/ .1925
Marmix	lb.	.41	/ .48
Merac	lb.	.75	/ 1.05
Micronex, colloidal	lb.	.06	/ .07
Monsanto Blue 4685 WD	lb.	1.60	
Green 4884 WD	lb.	1.80	
Red 127	lb.	1.25	
OPD-101	lb.	.16	/ .26
Pliolite Latex 150, 190	lb.	.32	/ .41
170	lb.	.37	/ .46
Polyvinyl methyl ether	lb.	.25	/ .45
Resin V	lb.	.13	
Roelgel 100C	lb.	.46	
Santomerse D	lb.	.44	/ .65
S	lb.	.13	/ .25
Sellogen Gel	lb.	.1275	
Sequestrene AA	lb.	.905	/ .975
30A	lb.	.245	/ .265
ST	lb.	.585	/ .615
Setsit #5	lb.	.75	/ 1.05
Stablex A	lb.	.80	/ 1.10
B, G	lb.	.50	/ .95
K	lb.	.27	/ .35
P	lb.	.35	/ .50
T	lb.	.14	/ .22
Webnix	lb.	1.50	/ 2.50

Mold Lubricants

Acintol D	lb.	.06	/ .075
Alipal CO-433	lb.	.25	/ .45
CO-436	lb.	.22	/ .41
Aquarex Compounds	lb.	.28	/ .97
Carbowax 200, 300, 400	lb.	.22	/ .25
1500	lb.	.255	/ .2825
4000	lb.	.31	/ .32
6000	lb.	.35	/ .36

CLASSIFIED ADVERTISEMENTS

ALL CLASSIFIED ADVERTISING MUST BE PAID IN ADVANCE

GENERAL RATES	SITUATIONS WANTED RATES	SITUATIONS OPEN RATES
Light face type $1.25 per line (ten words)	Light face type 40c per line (ten words)	Light face type $1.00 per line (ten words)
Bold face type $1.60 per line (eight words)	Bold face type 55c per line (eight words)	Bold face type $1.40 per line (eight words)
Allow nine words for keyed address.		*Letter replies forwarded without charge, but no packages or samples.*

Address All Replies to New York Office at 386 Fourth Avenue, New York 16, N. Y.

SITUATIONS WANTED

CHEMICAL ENGINEER. RECLAIM RUBBER DISPERSIONS AND Latex Adhesives, Granulated Cork, Composition Cork, Phenolic, Glue, Vinyl and Rubber-bonded for gasket and shoe platforms. Asphalt roofing, emulsions and tile, 15 years' responsible experience in development. Presently employed. Address Box No. 1592, care of RUBBER WORLD.

MOLDED AND MECHANICAL GOODS TECHNICAL MAN WITH 26 years' diversified experience in compounding, processing, control, industrial engineering, product development, supervision, and costs, desires position in Sales, Technical or Production Supervision. Desires full work load and responsibility. Can produce results effectively. May I send you a complete résumé for your consideration? Address Box No. 1593, care of RUBBER WORLD.

MANAGER—TECHNICAL DIRECTOR—RESEARCH DIRECTOR: Executive Chemist with over 12 years' well-rounded experience, including Assistant to the Vice President-General Manager, Technical Director, and Research Director of major companies, desires opporunity rubber or related industries. Experienced all phases molded, extruded, rubber-to-metal, sponge, latex foam, latex compounds, cements. Age 37, M.S., additional courses in Business and Plant Management. References cite leadership, ingenuity, efficiency, versatility, honesty, excellent presentation, ability to get the job done. Address Box No. 1594, care of RUBBER WORLD.

SITUATIONS OPEN

CHIEF DEVELOPMENT CHEMIST

Excellent opportunity for development chemist experienced with solvent-type rubber adhesives. Well-established, growing eastern concern. Address Box No. 1584, care of RUBBER WORLD.

HELP WANTED MALE

Large rubber manufacturer, Great Lakes Area, has excellent permanent position for young man with experience in technical rubber hose design, sales development, and product application work. Excellent employe benefits and pension. Our employes have been advised of this advertisement. Send full particulars of experience, education, age, salary range. Replies confidential. Address Box No. 1585, care of RUBBER WORLD.

PRODUCTS DEVELOPMENT & SALES OPENING

New England mechanical rubber manufacturer wants an experienced, top-flight man who can set up and direct a new division to manufacture diaphragm control valves, rubber-to-metal seals and other applications to rigid specifications. This man should have good sales contacts and the ability to find the job at the customer's drawing board and carry it through our laboratory, production, and inspection department. **This requires technical, production, and sales ability all in one man.** It is an unusual job for an unusual man with an unusual opportunity for high earnings and security in proportion to the individual's achievements. Write giving age, experience, and education. All replies held confidential. Our employes know of this ad. Address Box No. 1586, care of RUBBER WORLD.

CHEMICAL SALES: EXCELLENT OPPORTUNITY FOR CHEMIST with knowledge of industrial chemical applications, sound chemical education, research-minded preferably, desiring to enter industrial chemical sales field covering Midwest States, 50% of the time out of town. Good prospects for capable man desiring advancement to executive potential. Reply in detail stating age, experience, previous employment, starting salary desired first year. Address Box No 1587, care of RUBBER WORLD.

RUBBER FACTORY WANTS CAPABLE INDIVIDUAL TO TAKE charge of plant doing yearly volume $300-400,000. Must be honest, sincere, and ambitious. To such individual eventual interest in business will ensue. Basic knowledge of rubber compounding and manufacturing, especially in extrusion and calendering, necessary. Should be able to produce new products and ideas, and be capable of labor management. Excellent opportunity for progressive person. Location east metropolitan area. Address Box No. 1588, care of RUBBER WORLD.

RESEARCH CHEMIST

(Eastern Area)

Excellent opportunity for graduate Chemist. 2 to 5 years' experience with rubber materials desired—equivalent experience acceptable. Will work in the field of Adhesives. Write giving full particulars regarding age, experience, education, and salary expected.

ADDRESS BOX NO. 1575, C/O RUBBER WORLD

ANALYTICAL CHEMIST

Outstanding opening for graduate Chemist having 3 to 5 years' experience in Polymer Chemistry, including Rubber. Eastern location in medium-size community. Write giving full particulars regarding age, experience, education, and salary expected.

ADDRESS BOX NO. 1576, C/O RUBBER WORLD

SITUATIONS OPEN (Continued)

JUNIOR CHEMICAL ENGINEER

to train for Laboratory, Production and Process Development work in Southern branch plant of old established, well-known rubber manufacturer.

Requirements:
Graduate Chemical Engineer with minimum of one year experience in rubber compounding of mold and press, or mechanical goods.

Our employees know of this ad. Write and tell us all about yourself together with salary requirements at Box 1582, RUBBER WORLD.

LATEX CHEMIST

With degree in Chemistry or Chemical Engineering. Well rounded background in development of latex (natural and synthetic) compounds, principally DIPPED GOODS, foam, casting, and adhesives, with practical factory knowledge.

Excellent opportunity for advancement with old established company at good starting salary, with Insurance and Pension Plan paid by company.

Location: Midwest.

Replies held in strict confidence.

ADDRESS: BOX NO. 1583, c/o RUBBER WORLD

RUBBER CHEMICALS DEVELOPMENT

Leading California chemical research company has opportunities for several B.S. or M.S. chemists for development of rubber chemicals and allied products. Should have 2-3 years' experience in rubber emulsion polymerization or rubber compounding. Positions may lead to sales or technical service fields. Please write giving personal and work history to Box No. 1589, care of RUBBER WORLD.

OPPORTUNITY FOR CHIEF ENGINEER WITH MEDIUM-SIZED Midwest Rubber Company manufacturing molded and extruded mechanical goods. Strong background in rubber tooling and processing essential. Engineering degree preferred, but not essential. Man selected will have the cooperation of present Chief Engineer, who is accepting other duties. Address Box No. 1590, care of RUBBER WORLD.

WANTED: RUBBER CHEMIST. CLEVELAND, OHIO, MANUFACturing Company wants top-notch man with precision molded goods compounding experience, including O-Rings, Diaphragms, Seals, etc. If interested, write P. O. Box #6233, Cleveland 1, Ohio.

RUBBER MILL MANAGER TO TAKE COMPLETE CHARGE OF Mechanical and Cut Goods plant. Must have experience in production, costs, equipment, and molds. Excellent opportunity with expanding company. Address Box No. 1591, care of RUBBER WORLD.

RUBBER CHEMIST

With minimum of 4 years' experience in mechanical rubber goods compounding or similar field. Permanent position with excellent opportunity for advancement. Write: Personnel Manager, THE SUN RUBBER COMPANY, Barberton, Ohio.

EXPERIENCED TECHNICAL MAN WITH KNOWLEDGE OF pressure-sensitive tapes. Large company offering good future possibilities. Write Box No. 1602, care of RUBBER WORLD, giving full résumé and desired salary.

Material	Unit	Price	
Colite Concentrate	gal.	$0.90 /	$1.15
D-Tak Dip #10	gal.	1.50	
ELA	lb.	.82	
DC Mold Release Fluid	lb.	3.39 /	4.75
Emulsion Nos. 35, 35A, 35B	lb.	1.36 /	2.50
DC7	lb.	5.13 /	6.50
8	lb.	1.36 /	1.80
Glycerized Liquid Lubricant, concentrated	gal.	1.48 /	1.63
Igepals	lb.	.2875/	.47
Igepon AP-78	lb.	.44 /	.68
T-43	lb.	.145 /	.35
T-51	lb.	.125 /	.285
T-73	lb.	.285 /	.495
Lubrex	lb.	.25 /	.30
Lubri-Flo	gal.	10.00 /	12.05
Lustermold	lb.	.41	
Mold Paste	lb.	.25	
Monopole Oil	lb.	.16	
Monten Wax	lb.	.57	
Para Lube	lb.	.046 /	.048
Pluronics	lb.	.335 /	.44
Polyglycol E series	lb.	.29 /	.42
Rubber-Glo	gal.	.94 /	.97
Soap, Hawkeye	lb.	1.35 /	1.45
Purity	lb.	.155 /	.165
Sodium stearate	lb.	0.40	
Stoner's 700 series	gal.	1.20 /	1.25
800 series	gal.	1.26 /	1.70
900 Series	gal.	1.55 /	2.55
A Series	gal.	1.80 /	4.50
Ucon 50-HB Series	lb.	.25 /	.375
LB Series	gal.	2.18 /	3.04
Ulco	lb.	.12 /	.23
Vanfre	gal.	2.50 /	3.00

Odorants

Material	Unit	Price	
Alamasks	lb.	.75 /	6.50
Coumarin	lb.	2.95 /	3.55
Curodex 19	lb.	4.75 /	5.05
188	lb.	5.75	
198	lb.	6.75	
Ethavan	lb.	6.75 /	7.35
Latex Perfume #7	lb.	4.00	
Neutroleum Gamma	lb.	3.60	
Rubber Perfume #10	lb.	2.60	
Vanillin, Monsanto	lb.	3.00 /	3.15

Plasticizers and Softeners

Material	Unit	Price	
Acintol R	lb.	.065 /	.07
Adipol 2EH, 10A	lb.	.435 /	.465
BCA	lb.	.45 /	.475
ODY	lb.	.48 /	.51
Akroflex C	lb.	.695 /	.715
Aro Lene #1980	lb.	.10 /	.12
Baker AA Oil	lb.	.195 /	.24
Crystal O Oil	lb.	.21 /	.255
Processed oils	lb.	.215 /	.235
Bardol, 639	lb.	.215 /	.235
B	lb.	.0625/	.065
Bondogen	lb.	.55 /	.60
BRC 20	lb.	.15 /	.175
22	lb.	.025 /	.0275
30	lb.	.0125/	.021
521	lb.	.019 /	.02
BRH 2	lb.	.0213/	.0351
BRS 700	lb.	.02 /	.0285
BRT 7	lb.	.03 /	.031
BRV	lb.	.0475/	.0565
Bunarex Liquid	lb.	.0425/	.0555
Resins	lb.	.065 /	.1225
Bunnatol G.S.	lb.	.40 /	.505
Butac	lb.	.125 /	.135
Butyl stearate, comml	lb.	.24 /	.27
Binney & Smith	lb.	.23 /	.26
Hardesty	lb.	.23 /	.26
BxDC	lb.	.40 /	.41
Cabol 100	lb.	.02 /	.06
Califlux 510, 550	lb.	.025 /	.0325
G. P.	lb.	.0125/	.02
R-100	lb.	.045 /	.0525
TT	lb.	.017 /	.0245
Capryl alcohol, comml	lb.	.18 /	.20
Binney & Smith	lb.	.18 /	.28
Hardesty	lb.	.18 /	.28
Chlorowax 40	lb.	.145 /	.225
70	lb.	.18 /	.24
-S	lb.	.21 /	.27
Contogums	lb.	.0875/	.111
Cumar Resins	lb.	.065 /	.17
DBM (di butyl-m-cresol)			
Darex	lb.	.32 /	.3475
DBP (di butyl phthalate), comml	lb.	.30 /	.33
Darex	lb.	.30 /	.33
Hatco	lb.	.30 /	.43
Monsanto	lb.	.30 /	.33
Rubber Corp. of America	lb.	.30 /	.44
Sherwin-Williams	lb.	.30 /	.33
DBS (di butyl sebacate), comml	lb.	.66 /	.69
Hatco	lb.	.66 /	.785
Monoplex	lb.	.66 /	.675
DCP (di capryl phthalate), comml	lb.	.30 /	.33
Hatco	lb.	.295 /	.425
Monoplex	lb.	.30 /	.315
Ohio-Apex	lb.	.295 /	.325
DDA (di decyl adipate)			
Cabflex	lb.	.435 /	.465
DDP (di decyl phthalate)			
Cabflex	lb.	.305 /	.335
Hatco	lb.	.305 /	.435
Defoamer X-3	lb.	.355	
DIBA (di iso butyl adipate)			
Cabflex Di-BA	lb.	.4325/	.4625
Darex	lb.	.4325/	.4625
DIDA (di iso decyl adipate)			
Monsanto	lb.	$0.435 /	$0.465
DIDP (di iso decyl phthalate)			
Darex	lb.	.32 /	.35
Monsanto	lb.	.32 /	.35
Dielex B	lb.	.06	
Diethylene glycol, comml	lb.	.1325/	.16
Wyandotte	lb.	.15 /	.16
Dinopol IDO	lb.	.305 /	.335
DIOA (di iso octyl adipate)			
Cabflex Di-OA	lb.	.435 /	.465
Rubber Corp. of America	lb.	.435 /	.57
DIOP (di iso octyl phthalate), comml	lb.	.32 /	.34
Cabflex DI-OP	lb.	.305 /	.335
Darex	lb.	.32 /	.35
Hatco	lb.	.305 /	.435
Monsanto	lb.	.32 /	.35
Ohio-Apex	lb.	.305 /	.335
Rubber Corp. of America	lb.	.32 /	.45
Sherwin-Williams	lb.	.32 /	.34
DIOS (di iso octyl sebacate), comml	lb.	.61 /	.64
Rubber Corp. of America	lb.	.64 /	.84
DIOZ (di iso octyl azelate)			
Cabflex Di-OZ	lb.	.48 /	.5075
Dipolymer Oil	gal.	.33 /	.38
Dispersing Oil No. 10	lb.	.06 /	.0625
DNODP (di-n-octyl-n-decyl phthalate)			
Monsanto	lb.	.335 /	.365
DOA (di octyl adipate), comml	lb.	.435 /	.465
Cabflex	lb.	.435 /	.465
Hatco	lb.	.435 /	.565
Monsanto	lb.	.435 /	.465
Rubber Corp. of America	lb.	.435 /	57
DOP (di octyl phthalate), comml	lb.	.34 /	.35
Cabflex	lb.	.305 /	.335
Darex	lb.	.32 /	.35
Monsanto	lb.	.32 /	.35
Ohio-Apex	lb.	.305 /	.335
Rubber Corp. of America	lb.	.32 /	.45
Sherwin-Williams	lb.	.32 /	.34
DOS (di octyl sebacate), comml	lb.	.61 /	.64
Hatco	lb.	.61 /	.735
Monoplex	lb.	.61 /	.635
Rubber Corp. of America	lb.	.64 /	.84
Duraplex C-50 LV, 100%	lb.	.25 /	.295
Dutch Boy NL-A10 (DBP), -A-54	lb.	.30 /	.33
-A20 (DOP), A30 (DIOP)	lb.	.32 /	.35
-C20 (DOS)	lb.	.64 /	.66
-F21	lb.	.395 /	.425
-F31	lb.	.46 /	.49
-F41	lb.	.49 /	.52
Dutrex 6	lb.	.025 /	.035
Emulphor EL-719	lb.	.52 /	.73
Ethox	lb.	.43 /	.455
Ethylene glycol, comml	lb.	.13 /	.1575
Wyandotte	lb.	.1325/	.1425
Flexol 3 GH	lb.	.44 /	.46
3 GO	lb.	.53 /	.55
4 GO	lb.	.325 /	.355
TOF, A-26	lb.	.435 /	.465
Fortex	lb.	.125 /	.145
G. B. Asphaltic Flux	gal.	.08 /	.14
Naphthenic Neutrals	gal.	.11 /	.18
Process Oil			
Light	lb.	.025 /	.0325
Medium	lb.	.035 /	.0425
Galex W-100	lb.	.155 /	.18
W-100 D	lb.	.1525/	.1775
Gilsowax B	lb.	.09 /	.11
Good-rite GP-233	lb.	.435 /	.58
GP-261	lb.	.305 /	.455
Harchemex	lb.	.25 /	.34
Harflex 10	lb.	1.25 /	1.335
40	lb.	.66 /	.745
50, 80	lb.	.61 /	.695
60	lb.	.62 /	.705
90	lb.	.88 /	.965
120, 150	lb.	.32 /	.35
140, 160, 180	lb.	.30 /	.33
220	lb.	.435 /	.465
260	lb.	.42 /	.45
280	lb.	.43 /	.46
500	lb.	.315 /	.345
HB-20	lb.	.15 /	.17
-40	lb.	.22 /	.24
Heavy Resin Oil	lb.	.0225/	.0375
HSC-13	lb.	.27 /	.30
Indoil Compound 51-S	lb.	1.00 /	1.10
Indonex	gal.	.11 /	.19
Kapsol	lb.	.3225/	.3525
Kenflex A, L	lb.	.26 /	.27
B	lb.	.23 /	.24
N	lb.	.18 /	.19
Kessoflex 103	lb.	.405	
105	lb.	.3325	
106	lb.	.38	
107	lb.	.525	
110	lb.	.24	
111	lb.	.28	
KP-23	lb.	.29 /	.32
-90	lb.	.45 /	.48
-140	lb.	.46 /	.485
-201	lb.	.5825/	.5925
-220	lb.	.31 /	.34
-555	lb.	.45 /	.475
Kronisol	lb.	.33 /	.355
Kronitex AA, I	lb.	.33 /	.36
Marvinol plasticizers	lb.	.28 /	.8825
Methox	lb.	.385 /	.41
Monoplex S-38	lb.	.215 /	.24
S-71	lb.	.45 /	.475
Morflex	lb.	.25 /	.65
Neoprene Peeptizer P.-12	lb.	$1.05	
Nevillac	lb.	.39 /	$0.85
Neville R Resins	lb.	.13 /	.35
Nevinol	lb.	.20	
No. 1-D heavy oil	lb.	.065	
ODA (octyl decyl adipate)			
Cabflex	lb.	.435 /	.465
ODP (octyl decyl phthalate)			
Cabflex	lb.	.305 /	.335
Hatco	lb.	.305 /	.435
Rubber Corp. of America	lb.	.32 /	.45
Ohopex R-9	lb.	.3525/	.3775
Q-10	lb.	.295 /	.325
Orthonitro benzophenol, comml	lb.	.13 /	.15
Monsanto	lb.	.13 /	.15
Palmalene	lb.	.15	
Paradene Resins	lb.	.065 /	.075
Panaflex BN-1	lb.	.185 /	.225
Para Flux, regular	gal.	.10 /	.2125
No. 2016	gal.	.165 /	.24
2332	gal.	.11	
4205	lb.	.1075/	.2125
Para Lube	lb.	.046 /	.048
Resins	lb.	.04 /	.045
Paraplex 5-B	lb.	.34 /	.4075
AL-111	lb.	.32 /	.3275
G-25	lb.	.80 /	.805
-40	lb.	.52 /	.525
-50	lb.	.4175/	.4375
-53	lb.	.465 /	.485
-60	lb.	.335 /	.36
-62	lb.	.36 /	.385
RG-7	lb.	.37 /	.375
-8	lb.	.565 /	.5725
-10	lb.	.56 /	.5675
Paradene Resins	lb.	.065 /	.075
Peptizene #2	lb.	.90	
Pepton 22	lb.	.79 /	.82
Philrich 5	gal.	.11	
Picco Resins	lb.	.13 /	.185
Aromatic Plasticizers	lb.	.048 /	.065
480 Oilproof Series	lb.	.18 /	.23
Liquid Resin D-165	lb.	.08 /	.095
S. O. S.	gal.	.29 /	.34
Piccocizers	lb.	.04 /	.07
Piccolastic Resins	lb.	.1855/	.34
Piccolyte Resins	lb.	.185 /	.25
Piccopale Resins	lb.	.12 /	.135
Piccoumaron Resins	lb.	.07 /	.185
Piccovars	lb.	.145 /	.20
Piccovol	lb.	.025 /	.038
Pictar	gal.	.25 /	.30
Pigmentar, American	lb.	.041 /	.0678
Sunny South	lb.	.0389/	.0678
Pigmentaroil, American	lb.	.041 /	.0678
Sunny South	lb.	.0389/	.0678
Pitch, Burgundy			
Sunny South	lb.	.098 /	.1025
Plasticizer 35	lb.	.205 /	.24
36	lb.	.305 /	.34
42	lb.	.34 /	.40
B	lb.	.35 /	.45
DP-520	lb.	.435 /	.455
MT-511	lb.	.535 /	.565
ODN	lb.	.32 /	.37
PX series	lb.	.395 /	.75
SC	lb.	.61 /	.69
Plastogen	lb.	.0775/	.08
Plastone	lb.	.22 /	.30
Polycizers	lb.	.40 /	.4775
PT67 Light Pine Oil	gal.	.60	
101 Pine Tar Oil	gal.	.335 /	.445
Pine Tars	gal.	.35 /	.46
R-19, R-21 Resins	lb.	.1075	
Reogen	lb.	.1325/	.135
Resin C pitch	lb.	.0225/	.031
R6-3	lb.	.38 /	.40
Resinex	lb.	.0325/	.0375
L-4	lb.	.0225/	.03
Rosin Oil, Sunny South	gal.	.58 /	.875
RPA No. 2	lb.	.78	
3	lb.	.47	
Conc.	lb.	.97	
5	lb.	.59	
RSN Flux	gal.	.10 /	.19
Rubber Oil B-5	lb.	.0225/	.0355
Rubberol	lb.	.2575/	.2725
Santicizer 1-H	lb.	.50 /	.51
3	lb.	.46 /	.47
8	lb.	.43 /	.44
9	lb.	.39 /	.42
140	lb.	.33 /	.46
141	lb.	.34 /	.37
160	lb.	.25 /	.28
601, 602	lb.	.32	
603	lb.	.27	
B-16	lb.	.4875/	.4975
E-15	lb.	.5075/	.5375
M-17	lb.	.4275/	.4575
Sebacic acid, purified, comml	lb.	.64 /	.70
Binney & Smith	lb.	.64 /	.76
Hardesty	lb.	.64 /	.76
C.P.			
Binney & Smith	lb.	.72 /	.84
Hardesty	lb.	.72 /	.84
Seedinr	lb.	.1485/	.1705
Sherolatum Petrolatum	lb.	.05 /	.10
Softener #20	gal.	.10 /	.20
Special Rubber Resin 100	lb.	.1675/	.2175
Staflex AX	lb.	.43	
DBES	lb.	.61 /	.635
Starex Beads	lb.	.14 7/8 /	.15 7/8
Starite	lb.	.095 /	.10
Syn-Tac	gal.	.33 /	.35
Synthol	lb.	.2475	
Thiokol TP-90B	lb.	.59	
-95	lb.	.65	

CLASSIFIED ADVERTISEMENTS

Continued

MACHINERY AND SUPPLIES FOR SALE

FARREL 16" X 48" AND 15" X 36", 2-ROLL RUBBER MILLS, AND sizes to 84". New and used lab. 6" x 12" & 6" x 16" mills and calenders. American Tool 300-gallon Churns. Extruders 1" to 6". Baker-Perkins Jacketed Mixers 100, 50, and 9 gals. Brunswick 200-ton 21" x 21" platens. Large stock hydraulic presses 12" x 12" to 48" x 48" platens. Hydraulic Pumps and Accumulators. Rotary Cutters. Stokes Molding Presses. Single punch & Rotary Preform Machines, Banbury Mixers, Crushers, Kux 2½" dia. Preform Machine, Churns, Bale Cutters, etc. SEND FOR SPECIAL BULLETIN. WE BUY YOUR SURPLUS MACHINERY. STEIN EQUIPMENT CO., 107—8th St., Brooklyn 15, N. Y. STerling 8-1944.

FOR SALE: 1—6" X 16" LABORATORY MILL; 1—16 X 20" 2-Opening Hydraulic Press, 14" ram; 1—18" x 50" 3-roll calender; 1—6' x 4½' vertical vulcanizer, Q.O. door; also mixers, calenders, extruders, cutters, etc. CHEMICAL & PROCESS MACHINERY CORP., 146 Grand Street, New York 13, N. Y.

BREWSTER MACHINE CO.
New and Rebuilt Rubber Mill Machinery
Write or call JIM BROWN
349 E. Exchange St., Akron 4, Ohio, FR 6-2911

The Classified Ad Columns of RUBBER WORLD bring prompt results at low cost.

BUYING-SELLING
All kinds of *used* machinery for the Rubber and Allied Industries.

OFFERING NEW MACHINERY
Hydraulic Presses, Laboratory Mills and Presses, Sponge Rubber Vulcanizing Presses, Drilled Steel Steam Platens, Rubber Bale Cutters guillotine type, Vulcanizers with quick opening doors, etc

HIGH EFFICIENCY IN QUALITY, PRICE AND DELIVERY TIME

ERIC BONWITT 431 S. Dearborn Street Chicago 5, Ill.

AIR BAG BUFFING MACHINERY
STOCK SHELLS HOSE POLES
MANDRELS
NATIONAL SHERARDIZING & MACHINE CO.
868 WINDSOR ST. HARTFORD, CONN.
Representatives
Akron San Francisco New York

RUBBER HARDNESS
THE LANGUAGE OF THE RUBBER INDUSTRY SINCE 1915

DUROMETER
VARIOUS MODELS FOR TESTING THE ENTIRE RANGE

TECHNICAL DATA ON REQUEST

THE SHORE INSTRUMENT & MFG. CO., INC.
90-35 VAN WYCK EXPRESSWAY
JAMAICA 2, N. Y.

Economical **NEW** Efficient

Mills - Spreaders - Churns
Mixers - Hydraulic Presses
Calenders
...GUARANTEED...
Rebuilt Machinery for Rubber and Plastics

LAWRENCE N. BARRY
41 Locust Street Medford, Mass.

HOWE MACHINERY CO., INC.
30 GREGORY AVENUE PASSAIC, N. J.
Designers and Builders of
"V" BELT MANUFACTURING EQUIPMENT
Cord Latexing, Expanding Mandrels, Automatic Cutting, Skiving, Flipping and Roll Drive Wrapping Machines.
ENGINEERING FACILITIES FOR SPECIAL EQUIPMENT
Call or write.

REBUILT MACHINERY FOR RUBBER AND PLASTICS
—send us inquiries—convert surplus to cash—
BOLLING AND SON
3190 East 65th St. Michigan 1-2850 Cleveland 27, Ohio

NEW and REBUILT MACHINERY
Since 1891
L. ALBERT & SON
Trenton, N. J., Akron, Ohio, Chicago, Ill., Los Angeles, Calif.

GUARANTEED REBUILT MACHINERY
IMMEDIATE DELIVERIES FROM STOCK
MILLS, CALENDERS, TUBERS HYD. PRESSES, PUMPS, MIXERS
UNITED
VULCANIZERS, ACCUMULATORS CUTTING MACHINES, PULVERIZERS
UNITED RUBBER MACHINERY EXCHANGE
183-189 ORATON ST. CABLE "URME" NEWARK 4, N. J.

TR-11	lb.	$0.035	
Tricresyl phosphate, comml.	lb.	.33 /	$0.36
Monsanto	lb.	.33 /	.36
Triphenyl phosphate,			
comml.	lb.	.39 /	.40
Monsanto	lb.	.39 /	.40
Turgum S	lb.	.1075/	.1175
Tysonite	lb.	.24 /	.2475
United	gal.	.69 /	1.20
X-1 Resinous Oil	lb.	.021 /	.0275
XX-100 Resin	lb.	.0525	

Reclaiming Oils

Acintol C, P	lb.	.02 /	.03
Bardol, 639	lb.	.0275/	.0375
B	lb.	.0625/	.065
BRH 2	lb.	.0213/	.0351
BRT 3	lb.	.018 /	.0265
4	lb.	.025 /	.026
7	lb.	.03 /	.031
BRV	lb.	.0475/	.0565
Burco-RA	lb.	.053 /	.0805
BWH-1	lb.	.16 /	.18
Dipolymer Oil	gal.	.33 /	.43
Dispersing Oil No. 10	lb.	.06 /	.0625
G. B. Oils	gal.	.10 /	.24
Heavy Resin Oil	lb.	.0225/	.0375
LX-777	gal.	.23 /	.33
No. 1621	lb.	.025 /	.035
3186	gal.	.28 /	.295
Picco 6535	gal.	.25 /	.30
C-33	gal.	.215 /	.315
-42	gal.	.23 /	.33
D-4	gal.	.27 /	.37
E-5	gal.	.25 /	.35
Q-Oil	gal.	.286 /	.36
PT 67	gal.	.60	
101 Pine Tar Oil	gal.	.335 /	.445
150 Pine Solvent	gal.	.44	
Reclaiming Oil #3186	gal.	.28 /	.385
-G	gal.	.25 /	.365
4039-M	gal.	.3275/	.3975
-Y	gal.	.30 /	.37
RR-10	lb.	.36	
S. R. O.	lb.	.015 /	.0225
X-1 Resinous Oil	lb.	.021 /	.03

Reinforcers, Other Than Carbon Black

American Resinous Chemical			
978-42B	lb.	.18 /	.19
1073-18B	lb.	.135 /	.145
1294-36B	lb.	.115 /	.125
1301-12B	lb.	.15 /	.16
Angelo Shellacs	lb.	.485 /	.7325
BRC 20	lb.	.15 /	.175
22	lb.	.025 /	.0275
30	lb.	.0125/	.021
521	lb.	.019 /	.02
Bunarex Resins	lb.	.065 /	.1225
Cab-o-sil (compressed)	lb.	.77 /	.81
(Uncompressed)	lb.	.83 /	.87
Calcene NC	ton	72.50 /	92.50
TM	ton	75.00 /	95.00
Calco S. A.	lb.	.85 /	.88
Clays			
Aiken	ton	14.00	
Buca	ton	45.00	
Burgess HC-75	ton	12.00 /	30.00
HC-80	ton	14.00 /	32.00
Iceberg	ton	50.00 /	60.00
Pigment No. 20	ton	35.00 /	60.00
30	ton	37.00 /	60.00
Catalpo	ton	35.00	
Crown	ton	14.00 /	33.00
Dixie	ton	14.00	
Franklin	ton	13.50 /	35.25
L. G. B.	ton	17.00	
Paragon	ton	13.50 /	33.00
Pigment No. 33	ton	37.00	
Recco	ton	14.00	
Suprex	ton	14.00 /	33.50
Swanee	ton	12.50	
Whitetex	ton	50.00	
Windsor	ton	14.00 /	30.00
Witco No. 1	ton	14.00 /	30.00
No. 2	ton	13.50 /	30.00
Clearcarb	lb.	.1175/	.1225
Cumar Resins	lb.	.065 /	.17
Darex Resins	lb.	.42 /	.49
Diatomaceous silica	ton	32.00 /	48.00
Good-rite Resin 50	lb.	.42 /	.45
K Series Polymers	lb.	.15 /	.37
Hi-Sil 101	lb.	.10 /	.115
202	lb.	.11 /	.125
Indulins	lb.	.06 /	.08
Kralac A-EP	lb.	.43 /	.54
Laminar	ton	30.00	
Marbon Resins	lb.	.42 /	.49
Multifex	ton	140.00 /	155.00
MM	ton	110.00 /	125.00
Super	ton	160.00 /	175.00
Neville Resins			
465	lb.	.07 /	.0825
G	lb.	.13	
LX-509	lb.	.35	
Nebony	lb.	.04 /	.0575
Paradene	lb.	.065 /	.075
R	lb.	.13 /	.18
Para Resins 2457, 2718	lb.	.04 /	.45
Picco Resins	lb.	.13 /	.185
Piccolyte Resins	lb.	.185 /	.25
Piccoumaron Resins	lb.	.07 /	.185
Piccovars	lb.	.145 /	.20
Pliolite NR types	lb.	.98 /	1.33
S-3, -6, -6B	lb.	.42 /	.49
Purecal M	ton	56.75 /	71.75
SC, T	ton	110.00 /	125.00
U	ton	120.00 /	135.00
R-B-H 510	lb.	$0.15 /	$0.22
Resinex	lb.	.0325/	.0375
Rubber Resin LM-4	lb.	.28 /	.35
S-Polymers	lb.	.44	
Silene EF	ton	120.00 /	140.00
Silvacons	ton	55.00 /	85.00
Witcarb R	ton	105.00 /	120.00
-12	ton	45.00 /	66.00
Zeolex 23	ton	120.00 /	140.00
Zinc oxide, commercial†	lb.	.135 /	.1775

Retarders

Delac J	lb.	.55 /	.60
E-S-E-N	lb.	.35 /	.37
Good rite Vultrol	lb.	.62 /	.66
R-17 Resin	lb.	.1075/	.36
Retarder ASA	lb.	.57	
PD	lb.	.35 /	.37
TCM	lb.	.65	
W	lb.	.45	
Retardex	lb.	.47 /	.50
RM	lb.	1.25	
Thionex	lb.	1.25	

Solvents

3-BX Naphtha	gal.	.37	
Bondogen	lb.	.55 /	.60
Butyrolactone	lb.	.60 /	.65
Cosol #1	gal.	.37 /	.43
#2	gal.	.42 /	.48
Dichloro Pentanes	lb.	.04 /	.07
Dipentene DD	gal.	.445 /	.68
Ethylene dichloride, comml.	lb.	.09 /	.1225
GVL	lb.	1.00	
Hi-Flash 2-50-W	gal.	.41	
Pale yellow	gal.	.39	
LX-572	gal.	.27 /	.32
-748	gal.	.16 /	.23
n-Methyl-2-pyrrolidone	lb.	.75 /	.80
Neville Nos. 100, 104	gal.	.52 /	.60
106	gal.	.38 /	.46
Nevsol B	gal.	.20 /	.30
H, 200	gal.	.19 /	.29
HF, T, 30	gal.	.24 /	.34
Penetrell	gal.	.445 /	.68
Picco Hi-Solv Solvents	gal.	.19 /	.45
Pine Oil DD	gal.	.755 /	.955
PT 150 Pine Solvent	gal.	.44	
Skellysolve-E	gal.	.153	
-H	gal.	.133	
-R, -V	gal.	.109	
-S	gal.	.099	
Stauffer Carbon Disulphide	lb.	.0525/	.085
Tetrachloride	lb.	.0825/	.475

Synthetic Resins

Epon 828	lb.	.90 /	.935
Geon Latices (dry wt.)	lb.	.38 /	.52
Paste Resins	lb.	.38 /	.59
Plastics	lb.	.35 /	.80
Polyblend	lb.	.475 /	.575
Polyvinyl Resins	lb.	.38 /	.64
Kenflex A, L	lb.	.26 /	.27
B	lb.	.23 /	.24
N	lb.	.18 /	.19
Kraslastic B	lb.	.58 /	.93
D	lb.	.53 /	.88
F	lb.	.55 /	.90
H	lb.	.50 /	.85
J	lb.	.75 /	1.10
Marvinol MX-300	lb.	.41 /	.57
Rigid Vinyls	lb.	.69 /	1.38
VR-10, -20, -21	lb.	.38 /	.54
Plio-Tuf G75C, G85C	lb.	.52 /	.55
Polylite	lb.	.35	
Vibrin 115A	lb.	.37 /	.485
117, 151	lb.	.34 /	.455
119LS, 152LS	lb.	.38 /	.495
121	lb.	.46 /	.575
142	lb.	.55 /	.665

Synthetic Rubbers and Latices

PRIVATELY PRODUCED

Butaprene Latex (dry wt.)			
NL types	lb.	.47 /	.52
NXM types	lb.	.55 /	.60
Butaprene NAA	lb.	.54 /	.55
NF	lb.	.49 /	.50
NL	lb.	.50 /	.51
NXM	lb.	.58 /	.59
Chemigum 30N4NS,			
50N4NS	lb.	.50 /	.52
N1NS	lb.	.64 /	.66
N3NS	lb.	.58 /	.60
N6, N7	lb.	.50 /	.52
Chemigum Latex (dry wt.)			
101 types	lb.	.35 /	.42
200, 245 types	lb.	.47 /	.55
235 types	lb.	.55 /	.63
Hycar 1001, 1041	lb.	.53 /	.59
1002, 1042, 1043	lb.	.50 /	.51
1014, 1312	lb.	.60 /	.61
1411	lb.	.62 /	.63
1432	lb.	.59 /	.60
1441	lb.	.64 /	.65
Hycar Latex (dry wt.)			
1512, 1552, 1562, 1577	lb.	.46 /	.52
1551, 1561	lb.	.54 /	.60
1571	lb.	.59 /	.65
1572	lb.	.51 /	.57
Indulin-70-GR-S	lb.	.22 /	.23
Neoprene Latex (dry wt.)			
Type 571, 842-A	lb.	.37 /	.48
572	lb.	.39 /	.50
601-A, 735	lb.	.40 /	.51
735	lb.	.38 /	.49
Neoprene Type AC, CG	lb.	$0.55 /	$0.80
GN, GN-A, W, WHV	lb.	.41 /	.44
GRT, S	lb.	.42 /	.45
KNR	lb.	.75 /	.78
Q	lb.	1.00 /	1.03
WRT	lb.	.45 /	.48
Paracril 18-80	lb.	.60 /	.61
AJ	lb.	.485 /	.495
B, BJ	lb.	.50 /	.51
BV	lb.	.51 /	.52
C	lb.	.58 /	.59
CS, CV	lb.	.59 /	.60
Paraplex X-100	lb.	1.00	
Silastic	lb.	2.30 /	4.05
Thiokol LP-2, -3, -32, -33	lb.	.96	
-8, -38	lb.	1.25	
PR-1	lb.	.95	
Type A	lb.	.47	
FA	lb.	.69	
ST	lb.	1.00	
Thiokol Latex (dry wt.)			
Type MF	lb.	.85	
MX	lb.	.70	
WD-2	lb.	.92	
-5	lb.	.95	
-6, -7	lb.	.70	
Vistanex types	lb.	.45	

GOVERNMENT

Hot GR-S Non-Pigmented

Staining		
1000, 1004, 1007, X-759	lb.	.23
1002, 1005, 1015, 1016, 1023	lb.	.2325
1021	lb.	.24
Slightly Staining		
1001	lb.	.23
1014	lb.	.235
Non-Staining		
1006, 1010, 1012, 1013	lb.	.23
1009, 1019	lb.	.2325
1018, 1022	lb.	.235

Hot GR-S Black Masterbatches

Staining		
1100	lb.	.185
Slightly Staining		
1104	lb.	.18

Cold GR-S Non-Pigmented

Staining		
1500, 1505, X-762	lb.	.23
Slightly Staining		
1501	lb.	.23
Non-Staining		
1502	lb.	.23
1503, 1504	lb.	.2325

Cold GR-S Black Masterbatches

Staining		
1600, 1601, 1602	lb.	.185

Cold GR-S Oil Masterbatches

100 parts GR-S, 25 parts oil		
1703	lb.	.195
1705, 1706	lb.	.1925
100 parts GR-S, 37.5 parts oil		
1707, 1708	lb.	.18
1709, 1710, 1711, 1712	lb.	.1775

Cold GR-S Oil Black Masterbatches

Staining		
1801	lb.	.17
X-763	lb.	.1575

GR-I Polymers

GR-I, 15,* 17,* 18,* 25, 35, 50*	lb.	.23

Latices†

Hot latices		
2006	lb.	.215
2000, 2001	lb.	.2275
2004	lb.	.26
2003	lb.	.265
2002	lb.	.275
2005	lb.	.28
Cold latices		
X-617, -734	lb.	.225
X-765	lb.	.235
2100, X-760	lb.	.255
X-667, -711, -758	lb.	.26
X-684, -710	lb.	.2675
X-633	lb.	.275

Tackifiers

American Resinous Chemical			
A25, A26, 716-30	lb.	.18 /	.19
555-40R	lb.	.185 /	.205
620-32B	lb.	.20 /	.21
716-35	lb.	.17 /	.18
1041-21	lb.	.165 /	.175
Acintol R	lb.	.065 /	.07
Bardol, 639	lb.	.0275/	.0375
BRH 2	lb.	.0213/	.0351
Bunarex Resins	lb.	.065 /	.1225
Chlorowax 70	lb.	.18 /	.24
Contogums	lb.	.0875/	.11
Cumar Resins	lb.	.065 /	.17

* Also available packed in coated cartons at the same price.

† These prices are for latex in tank-car quantities 10,000 gallons).

CLASSIFIED ADVERTISEMENTS

Continued

MACHINERY AND SUPPLIES FOR SALE (Continued)

FOR SALE: COMPLETELY MODERN, ALMOST NEW, VINYL coating unit, gas fired. Will process 60″ width fabric, complete with drive motors, explosion alarm, ready to set up and operate; also 1—Keenok Color Grinder, 300 pounds per hour capacity; also 1—100-gallon porcelain-lined Ball Mill. PHILADELPHIA TEXTILE FINISHERS, INC., Norristown, Pa.

MACHINERY & SUPPLIES WANTED

WANTED: PLANT OR MACHINERY INCL. RUBBER MILLS, Calenders, Mixers, Banbury Mixers, Extruders, Grinders, Cutters, Hydraulic Presses, Injection Molding Machines. CONSOLIDATED PRODUCTS CO. INC., 64 Bloomfield Street, Hoboken, N. J. BArclay 7-0600.

WANTED: USED PRESSES, 30″ X 54″ MINIMUM PLATEN, 500-ton minimum pressure. Prefer French Oil. Advise price, make, condition, etc. Address Box No. 1595, care of RUBBER WORLD.

70″ SPREADER (KNIFE COATER), 70″ DRY CANS, 70″ CURE box. Address Box No. 1596, care of RUBBER WORLD.

BUSINESS OPPORTUNITIES

RUBBER MOLDS

I will invest up to $5,000 in rubber molds for the manufacture of any item which will stand careful scrutiny. GEORGE B. FARWELL, 1045 Sonoma Avenue, Menlo Park, Calif.

THE PROPRIETORS OF THE FOLLOWING PATENTS ARE OPEN to receive offers for the outright purchase of same: 2,264,237 (Nov., '41); 2,343,529 (Mar., '44); 2,537,395 (Jan., '51); 2,551,872 (May, '51); 2,586,607 (Feb., '52); and Can. Pat. 449,589 (July, '48). All for continuous processing machinery for rubber and plastics. Address Box No. 1597, care of RUBBER WORLD.

WE ARE BABY PRODUCTS MANUFACTURERS, SELLING every leading jobber in this field. We wish to contact mfgs. having either stock molds of Baby items or products available for exclusive distribution to this trade. Address Box No. 1598, care of RUBBER WORLD.

WANTED: MANUFACTURER WHO CAN MAKE POUCH-LIKE device of white rubber stock, finished by a single curing operation. Address Box No. 1599, care of RUBBER WORLD.

WILL PURCHASE OUTRIGHT
RUBBER MANUFACTURING PLANT

We are open to purchase complete or make substantial investment in medium-sized rubber manufacturing plant well equipped and now operating. Furnish all details. Address Box No. 1600, care of RUBBER WORLD.

SURPLUS PRODUCTION FACILITIES AVAILABLE

Have large well-equipped plant for machinery making, now producing rubber manufacturing equipment. May we ease your production problems? Address Box No. 1601, care of RUBBER WORLD.

The Classified Ad Columns of RUBBER WORLD
bring prompt results at low cost.

Galex W-100	lb.	$0.155 /	$0.17
W-100D	lb.	.1525/	.1675
Indopol H-35	gal.	.65 /	.81
H-50	gal.	.70 /	.86
H-100	gal.	.85 /	1.05
H-300	gal.	1.00 /	1.21
L-10	gal.	.40 /	.56
L-50	gal.	.45 /	.61
L-100	gal.	.55 /	.71
Kenflex resins	lb.	.18 /	.27
Koresin	lb.	.90 /	1.10
Natac	lb.	.12 /	.13
Nevindene	lb.	.15 /	.18
Picco Resins	lb.	.13 /	.185
Piccolastic Resins	lb.	.1855/	.34
Piccolyte Resins	lb.	.185 /	.25
Piccopale Resins	lb.	.12 /	.135
Piccoumaron Resins	lb.	.07 /	.185
R-B-H 510	lb.	.15 /	.22
Roelflex 1118A	lb.	.39	
Synthetic 100	lb.	.41	
Synthol	lb.	.2475 /	.2625
United	gal.	$0.69 /	$1.20

Vulcanizing Agents

Dibenzo G-M-F	lb.	2.60	
G-M-F #113, #117	lb.	.90	
Ko-Blend I, S	lb.	.385	
Litharge (*See Accelerator-Activators, Inorganic*)			
Magnesium oxide	lb.	.23 /	.25
Red lead (*See Accelerator-Activators, Inorganic*)			
Sufsal R	lb.	1.50	
Sulfur flour, comml.	100 lbs.	2.20 /	3.05
Aero	100 lbs.	2.15 /	7.50
Crystex	lb.	.195 /	.23
Insoluble 60	lb.	.125 /	.13
Rubbermakers	100 lbs.	2.40 /	4.30
Stauffer	lb.	.024 /	.0515
Telloy	lb.	2.50	
Vandex	lb.	6.00	
Vultac No. 2	lb.	.47 /	.755
3	lb.	.51 /	.795
White lead silicate (*See Accelerator-Activators, Inorganic*)			

United States Rubber Statistics—July, 1954

(All Figures in Long Tons, Dry Weight)

	New Supply			Distribution		
	Production	Imports	Total	Consumption	Exports	Month-End Stocks
Natural rubber and latex, total	0	40,614	40,614	37,894	565	109,564
Rubber, total	0	35,378	35,378	33,596	565	99,393
Latex, total	0	5,236	5,236	4,298	0	10,171
Synthetic rubbers, total	*40,374 †6,590	1,286	48,250	40,226	3,125	162,944
GR-S types‡	*35,415 †103	1,285	36,700	31,474	1,126	128,752
Butyl	*4,959	1	4,960	4,108	421	18,150
Neoprene‡	†4,673	0	4,673	3,499	1,220	11,315
Nitrile type‡	†1,814	0	1,814	1,145	358	4,727
Natural rubber and latex, and synthetic rubber, total	46,964	41,900	88,864	78,120	3,690	272,508
Reclaimed rubber, total	17,907	134	18,041	16,301	586	31,304
GRAND TOTALS	64,871	42,034	106,905	94,421	4,276	303,812

*Government plant production.
†Private plant production.
‡Includes latices.
SOURCE: Chemical & Rubber Division, BDSA, United States Department of Commerce, Washington, D. C.

Estimated Pneumatic Casings, Tubes, Camelback: Shipments, Production, Inventory—August, July, 1954; August, 1953; First Eight Months, 1954-1953

Passenger Casings	Original Equipment	Replacement	Export	Total	Production	Inventory
August, 1954	2,283,676	4,605,213	72,726	6,961,615	4,709,676	7,797,072
Change from previous month				−10.89%	−15.97%	−22.52%
July, 1954	2,516,395	5,222,699	72,864	7,811,958	5,604,516	10,063,142
August, 1953	2,756,652	4,649,302	86,460	7,492,414	6,388,840	10,683,635
First 8 mos., 1954	20,548,631	34,117,355	594,560	55,260,546	50,166,301	7,797,072
1953	23,628,191	34,444,027	481,835	58,554,053	57,892,883	10,683,635
Truck and Bus Casings						
August, 1954	243,300	823,913	50,701	1,117,914	717,454	2,187,744
Change from previous month				+4.14%	−5.03%	−15.11%
July, 1954	265,189	726,020	82,214	1,073,423	755,435	2,576,996
August, 1953	372,334	874,881	57,363	1,304,578	1,009,283	2,866,203
First 8 mos., 1954	2,488,103	5,240,517	554,943	8,283,563	7,768,447	2,187,744
1953	3,483,562	6,437,866	459,142	10,380,570	10,383,016	2,866,203
Total Automotive Casings						
August, 1954	2,526,976	5,429,126	123,427	8,079,529	5,427,130	9,984,816
Change from previous month				−9.07%	−14.67%	−21.01%
July, 1954	2,781,584	5,948,719	155,078	8,885,381	6,359,951	12,640,138
August, 1953	3,128,986	5,524,183	143,823	8,796,992	7,398,123	13,549,838
First 8 mos., 1954	23,036,734	39,357,872	1,149,503	63,544,109	57,934,748	9,984,816
1953	27,111,753	40,881,893	940,977	68,934,623	68,275,899	13,549,838
Tractor-Implement Casings						
August, 1954	122,246	119,141	7,185	248,572	127,653	485,241
Change from previous month				+0.59%	−25.51%	−18.62%
July, 1954	103,967	136,916	6,220	247,103	171,362	596,281
August, 1953	139,024	105,242	5,228	249,494	262,075	757,181
First 8 mos., 1954	1,293,428	1,028,999	53,510	2,375,937	2,002,282	485,241
1953	1,932,055	1,047,572	42,410	3,022,037	2,894,345	757,181
Passenger, Motorcycle, Truck and Bus Inner Tubes						
August, 1954	2,174,214	3,504,429	69,048	5,747,691	3,773,162	6,627,752
Change from previous month				−8.14%	−8.69%	−21.37%
July, 1954	2,706,698	3,463,617	86,760	6,257,075	4,132,433	8,429,033
August, 1953	3,137,279	3,311,622	74,040	6,522,941	5,675,356	10,225,911
First 8 mos., 1954	22,605,157	25,869,697	627,672	49,102,526	43,509,123	6,627,752
1953	27,122,443	26,989,207	499,544	54,611,194	53,735,606	10,225,911
Camelback (Lbs.)						
August, 1954	—	27,261,105	401,274	27,662,379	21,487,349	21,747,741
Change from previous month				+7.92%	−4.39%	−16.09%
July, 1954	—	24,890,488	742,485	25,632,973	22,473,088	25,917,376
August, 1953	—	23,390,554	584,836	23,975,390	20,276,813	29,824,673
First 8 mos., 1954	—	179,551,495	5,581,534	185,133,029	177,615,633	21,747,741
1953	—	169,549,415	5,022,534	174,571,949	178,740,208	29,824,673

NOTE: Cumulative data on this report include adjustments made in prior months.
SOURCE: The Rubber Manufacturers Association, Inc., 444 Madison Ave., New York 20, N. Y.

RAYON

Total calculated production of rayon and acetate by domestic producers during September was 85,800,000 pounds of which 20,100,000 pounds were rayon high-tenacity yarn. Total shipments of rayon and acetate amounted to 94,000,000 pounds during the month, an increase of 4% over August shipments and 7½% higher than the September, 1953, figure of 87,400,000 pounds. September shipments of rayon high-tenacity yarn at 28,200,000 pounds were 40% above August shipments and the highest since April, when 30,400,000 pounds of the yarn were shipped.

Month-end stocks declined sharply; rayon and acetate fell to 95,100,000 pounds while rayon high-tenacity yarn dropped to 10,900,000 pounds.

No price changes were noted for rayon tire yarn and fabrics during the period from September 16 to October 15.

Rayon Prices

Tire Yarns

High Tenacity		
1100/ 480	$0.62 /	$0.6
1100/ 490	.62	
1150/ 490	.62	
1165/ 480	.63	
1230/ 490	.62	
1650/ 720	.61	
1650/ 980	.61	
1875/ 980	.61	
2200/ 960	.60	
2200/ 980	.60	
2200/1466	.67	
4400/2934	.63	
Super High Tenacity		
1650/ 720	.64	
1900/ 720	.64	

Tire Fabrics

1100/490/2	.72	
1650/980/2	.695 /	.7
2200/980/2	.685	

Financial

(*Continued from page 260*)

Sidney Blumenthal & Co., New York, N. Y. Nine months to September 30, 1954: net loss, $612,948, contrasted with net profit of $122,073 a year earlier.

Boston Woven Hose & Rubber Co., Cambridge, Mass. Year ended August 31, 1954: net loss, $432,005, contrasted with net profit of $208,746 in the preceding fiscal year; net sales, $15,259,855, against $16,683,690; current assets, $7,034,028, current liabilities, $817,647, against $7,474,030 and $1,252,825, respectively, on August 31, 1953.

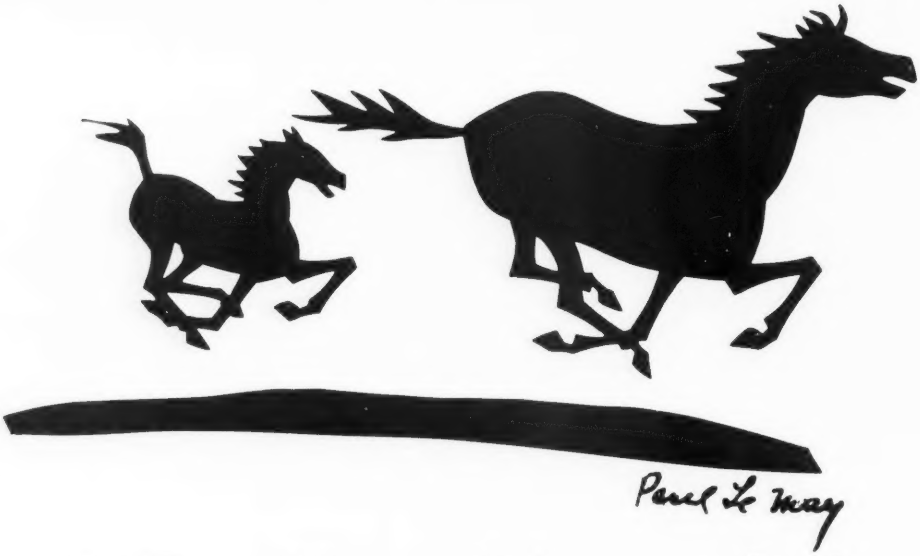
DeVilbiss Co., Toledo, O., and wholly owned subsidiary. First nine months, 1954: net profit, $530,807, equal to $1.77 a share, compared with $641,234, or $2.14 a share, in the 1953 months.

Dow Chemical Co., Midland, Mich., and subsidiaries. Quarter ended August 31, 1954: net income, $8,544,028, equal to 36¢ each on 22,651,010 common shares, against $9,762,957, or 43¢ each on 22,007,010 shares, in the 1953 period; net sales, $107,822,510, against $110,503,775.

The Eagle-Picher Co., Cincinnati 1, O. Nine months ended August 31, 1954: consolidated net profit, $1,227,610, equal to $1.24 a share, contrasted with $2,492,693, or $2.52 a share, a year earlier; net sales, $56,133,885, against $66,581,893.

INDEX TO ADVERTISERS

This index is maintained for the convenience of our readers. It is not a part of the advertisers' contract and RUBBER WORLD *assumes no responsibility to advertisers for its correctness.*


Paul Le May